

# RIGAMAROLE

FALL 2014 ISSUE NO. 33



DIAMOND  
OFFSHORE

# RIGAMAROLE

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PRESIDENT AND CHIEF EXECUTIVE OFFICER



*With this issue, Diamond Offshore commemorates ten years of publishing Rigamarole in its current format. This anniversary provides an apt occasion to reflect upon what has happened in our industry during the past ten years, and more importantly, what might lie ahead.*

From a personal perspective, this edition is of particular relevance as it's my first since joining Diamond Offshore as President and CEO in March of this year. I have communicated my thoughts regularly with the Diamond organization since I came on board, but I'll take the opportunity once again to share what I have seen in my first few months. Let me start with the people I have met, both on the rigs and in our offices around the world. We have a passionate workforce that takes pride in what we do; we have people who come to work to make a difference; and we have employees who care about their colleagues, their customers and the environment in which we work. They care about building on the "*Diamond Difference*."

Everyone is aware of how difficult the offshore drilling market has become. We are facing an unprecedented wave of newbuild drillships coming to market, the majority of which are uncontracted. Our clients are significantly cutting back on offshore spending as their shareholders demand better returns.

But we know our business is cyclical, and we have successfully weathered storms before. This is where the *Diamond Difference* is so important. We have the best maintained assets and the best trained people. Proof positive of this is that in Q2 of this year we only had 52 days of unplanned downtime across a fleet of 41 active assets. We collectively strive for a workplace where no one gets hurt and uptime is best in class. We want to provide a superior level of customer service that makes Diamond the preferred vendor of choice.

So quite a tall ask then? Not really when we are already close. Which is why each and every one of

Diamond's talented employees' contribution is so important. This is what contributes to the *Diamond Difference* and will get us across the line first. We will emerge from this cycle with an even brighter shine.

As we look to the future, it is also important that we don't forget the past and the efforts that many have undertaken to get us into the position of relative corporate strength. In this anniversary edition of Rigamarole, we feature some past stories from over the years that are still relevant today. Our lead article discusses the *Ocean Endeavor's* long journey to reach the Black Sea where it is currently working for ExxonMobil. In addition to telling the tale of how the rig was squeezed through the Bosphorus Strait, we revisit its delivery from our rig upgrading program, along with its sister rig, the *Ocean Monarch*. We take a look at our acquisition of the *Ocean Courage* and then conclude with a current summary of our newbuild program.

This issue also represents the final publication of Rigamarole as a traditional printed magazine. In its place will be similar content, but it will be designed to live online: a format that is compatible with how most of us enjoy our reading these days—on a tablet, smartphone, or internet browser. This will allow us to update content on a more frequent basis, much like a newspaper website. Your comments and feedback are certainly of interest to us, so the online version will allow you to submit feedback on specific articles.

We hope you enjoy this issue and future editions of Rigamarole and that they will inspire your continued interest in Diamond Offshore. I am also looking forward to what the next ten years bring to our great company.

*In 2012, beneath the deep waters of the Black Sea, ExxonMobil and OMV Petrom made a gas discovery off the coast of Romania.*

*The Ocean Endeavor—outfitted with the latest drilling technologies and equipment—had to be brought to the area in order to confirm the find’s potential. But before any drill bit could bite into the silty sea bottom, an unfathomable question had to be answered.*

**HOW  
DO YOU  
CHOP  
A 376  
FOOT-  
TALL  
RIG IN  
HALF  
?**





WRITTEN BY *SCOTT REDEPENNING*  
PHOTOGRAPHY BY *CHRIS SHINN and RICH CROWDER*



**AN  
EXTRA  
ORDINARY  
ENDEAVOR**





In January 2014, Diamond Offshore's *Ocean Endeavor* completed a drilling contract in Egypt. ExxonMobil, working with Romania's OMV Petrom, then secured the ultra deepwater rig to work a newly expanded drilling program in the Black Sea. Typically when a contract ends, Diamond Offshore will relocate a rig anywhere in the world where it is needed next. In fact, contracts in recent years had seen the massive *Endeavor* towed from Singapore to the Gulf of Mexico to Egypt. In relative terms, this latest trip from Egypt to nearby Romania looked to be a quick and easy jaunt. But there were two very thin, yet very formidable obstacles standing in the way.

The Black Sea is a 270,400-square-kilometer water mass that is virtually landlocked by Romania, Ukraine, Russia, Georgia, Turkey and Bulgaria. The only waterway in and out is the narrow Bosphorus

Strait, which cuts through the heart of Istanbul, connecting the Black Sea to the Aegean and ultimately the Mediterranean. Two sleek bridges soar 64 meters (210 feet) high over the Bosphorus, more than enough clearance for the world's largest ships to pass safely below. But the bridge designers didn't count on a seagoing vessel with an enormous pointed tip towering 115 meters (376 feet) skyward. To get the *Endeavor* underneath, the derrick would have to be taken off, laid down for the passage and put back up on the other side—in effect the most challenging limbo contest Diamond Offshore has ever attempted.

## HAVE RIG, WILL TRAVEL

Kyle Bardsley is the Project Engineer in charge of mobilizing the *Endeavor* into the Black Sea. He came to the project at its earliest planning stages in mid 2012. Now, at age 29 and the

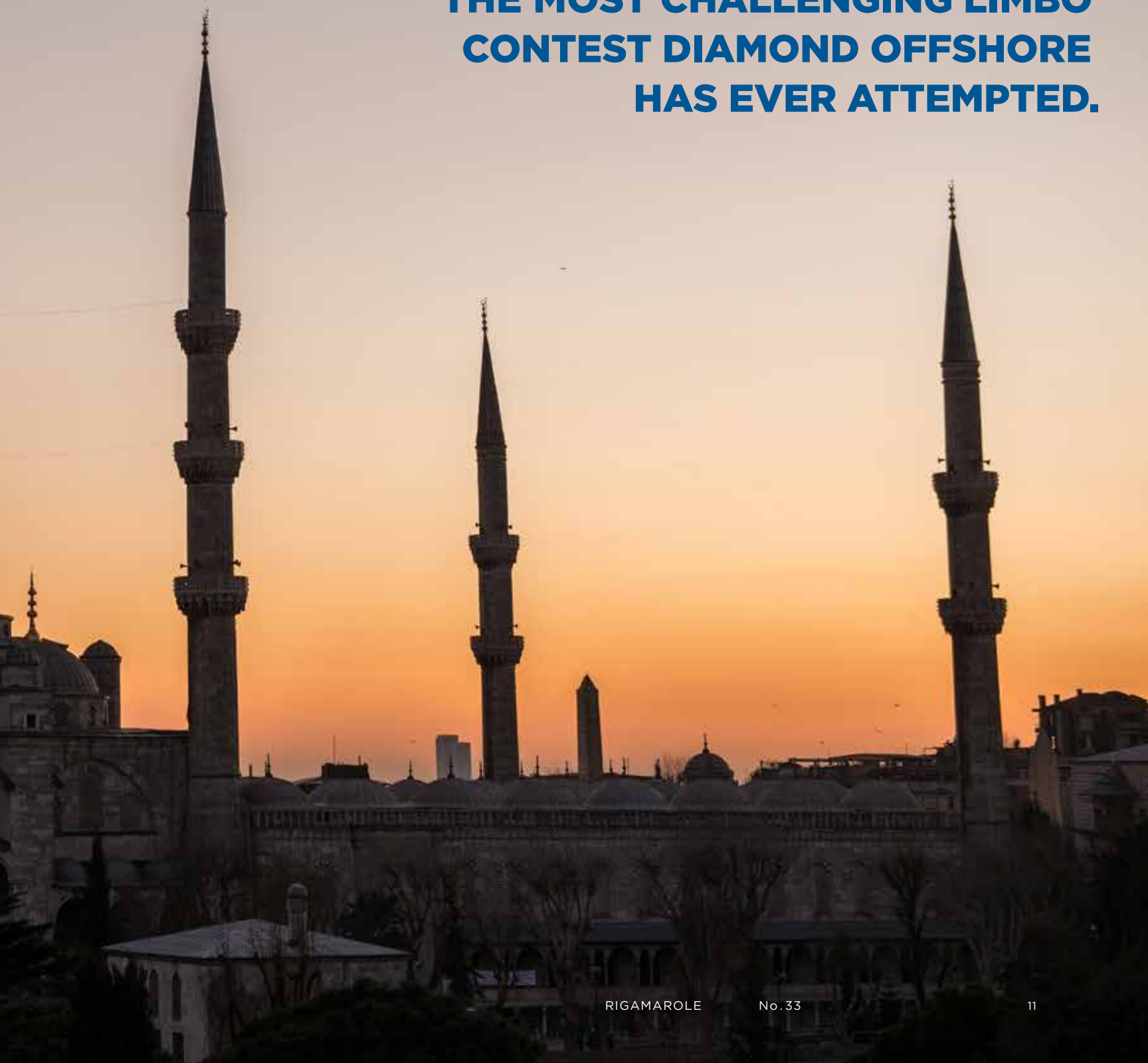
project nearing the finish line, a few gray hairs have crept into his otherwise youthful countenance, hinting at the challenges he and his team have faced for the last several months.

“This is the first time Diamond Offshore has done anything like this on a rig this big. This is a very unusual project,” he says. “The mobilization is taking roughly half a year before any drilling can be done at a significant cost to our client. I think that shows the potential ExxonMobil sees in the Black Sea. We will be drilling several wells in Romanian and Russian waters, and ExxonMobil holds options to extend the contract beyond that. I think the rig could be here for a good long while.”

The mobilization phase of the project started on January 18th, and some 174 days, 2,583 nautical miles and 130,000 man-hours later, the



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# **“BREAKING THIS RIG BASICALLY IN HALF TOOK A LOT OF CAREFUL PLANNING. OUR DISASSEMBLY APPROACH BEGAN WITH LOOKING AT HOW THE RIG HAD BEEN PUT TOGETHER. WE KNEW THE DERRICK WAS BUILT IN THREE SECTIONS. WE KNEW THE CRANES GO UP PIECE BY PIECE. SO WE BASICALLY REVERSE ENGINEERED IT.”**

*Endeavor* commenced drilling its first well. But Bardsley brings the story of this most uncommon aquatic journey back to the beginning. First stop—Palermo, Italy.

“It took about 14 days to move the rig from Egypt to Fincantieri Shipyard in Palermo, and that presented one of our first big challenges,” he says. “We needed four tugs and there was only one available locally with adequate horsepower, so the other three had to come from neighboring ports. Two came from Messina, Sicily, and the third from Valetta, Malta. It was a big cost to mobilize these tugs to Palermo, however we could not jeopardize the safety of the crew and rig by using anything smaller. Once the tugs got us docked, we started to break the *Endeavor* down.”

When fully loaded for drilling, the *Endeavor* weighs in at an awe-inspiring 42,463 tons of steel, fluids and machinery. The rig hums and throbs as if it’s alive. It seems that once built, this beast could never be broken. But the job in Palermo was to do just that. Essentially, the *Endeavor* was broken down and brought to the Black Sea in pieces. “To get under the bridges in Istanbul, we had to remove the derrick and three deck cranes, which together weigh 1,171 tons,” says Bardsley.

“We broke them down and loaded them on a cargo ship, along with the riser, drilling tubulars, third-party equipment, tensioners, anchors and our shorebase spares.”

Bardsley points out that no rig is ever built with deconstruction in mind. “Breaking this rig basically in half took a lot of careful planning. Our disassembly approach began with looking at how the rig had been put together. We knew the derrick was built in three sections. We knew the cranes go up piece by piece. So we basically reverse engineered it.”

Easy to say, difficult to execute. The derrick is 48 feet square at its base and 170 feet tall, built to handle staggering hook loads up to 2,000 kips. The deck cranes consist of two 90-ton SeaTrax units with 180-foot booms, and one 65-ton unit with a 160-foot boom. Before all this bulk could be budged, a giant floating crane taller than the rig had to be brought in to do the heavy lifting. “The crane we used came down to Palermo from Rotterdam in the Netherlands,” says Bardsley. “Once it arrived, it took five days just to rig itself up. It took down the derrick and deck cranes, then they spent another seven days de-rigging so it could follow us to Romania to put the *Endeavor* back together.”

Breaking down the derrick was basically a matter of unbolting the three main sections, but the SeaTrax cranes presented a more complicated challenge. These towering hoists sit upon massive steel kingposts—solid cylinders that were meant to be permanent supports and never tampered with. “We cut right through them,” says Bardsley. “It was one of the coolest things we did. We had these huge clamshell lathes made, which attach to the kingposts like two giant horseshoes to do the cutting. The lathes machined the cranes right off an eighth of an inch at a time, leaving a nice smooth weld groove for when it came time to reattach them. A team of specialists came in to do the work and it took three days to cut the cranes off.”

With the derrick, cranes and equipment removed, and all the ballast water pumped out, the remainder of the rig tipped the scales at 25,163 tons—the weight that would have to be hoisted completely out of the water by the heavy-lift ship that was hired to carry the rig to Romania. Bardsley says there are only a handful of vessels in existence that can contend with a cargo such as the *Endeavor*. “The two biggest heavy-lift ships in the world can handle the rig without any modifications, but they



were both booked up, so we had to use a slightly smaller, narrower ship,” he says. “Under normal circumstances the *Endeavor* could not be shipped on this vessel due to stability issues in the open sea. But it was a different story with the derrick and cranes removed, which brought the rig’s weight and center of gravity much lower. However, we did need to reinforce the rig’s lower hull to compensate for the narrowness of the lift ship. Once out of the water, more than 50 percent of the *Endeavor* would be hanging off the sides of the ship. It looked like it defied the laws of physics. But our structural engineers and naval architects spent a lot of time up front proving that the plan would work.”

## WARMING UP FOR WORK

Winters in the Black Sea are bitterly cold, a condition the *Endeavor* had never encountered. Before she could leave Palermo, preparations had to be made. “This rig was designed to work in tropical environments, so all the piping was exposed,” says Bardsley. “We installed about five kilometers of heat tracing, and we closed off certain areas with a high concentration of piping and equipment, which was a good economical decision but also makes for a cleaner rig. We also had to think of our people. The rig had a bunch of really good air conditioners, but no heaters. We installed 75 heaters in different workspaces throughout the rig. We also installed 14 tank heaters to keep potable water, salt water and drill water from freezing, and we had to put in eight power substations just to run all this new equipment.”

Bardsley says winterization was the largest and costliest job on the project. “When you look at taking down the derrick and cranes and the heavy-lift mobilization, those are big, glamorous operations. The winterization isn’t something you can even see looking at the rig, but it is essential to make sure we don’t have any downtime offshore when the temperatures go below freezing.”

Other modifications included adding a 12-man quarters to increase the number of personnel who can work on the rig to 152. The helipad was also extended 12 feet outward and six feet on each side. After Romania, ExxonMobil plans to drill in Russian waters where they still use the old Soviet Mil helicopters. These bulky relics significantly outsize the choppers typically used offshore, and the *Endeavor*’s helipad had to accommodate.

## THE PASSAGE

After 43 hard-working days in port, the *Endeavor* in her various pieces were ready to bid Palermo arrivederci. The first step after pushing away from the shipyard was a three day process known as sea fastening, in which the rig is secured to the heavy-lift ship to make sure it won’t move around during transport. Bardsley explains that special fasteners were welded to the ship’s deck and to the underside of the rig. “Think of it like a giant zipper. These fasteners basically zip together to connect the two vessels,” he says. “So when the ship encounters wave motion, the rig won’t slide off. Also, it would be unlikely, but if for some reason the ship goes down,

physical pulling forces from the buoyant rig hull would ‘unzip’ the *Endeavor* and allow it to float free.”

Thus riding piggyback, the *Endeavor* embarked on the 1,260-nautical-mile journey to the city of Constanta on the Romanian coast, where she would rendezvous with the cargo ship and floating crane and reassembly would take place. East across the Mediterranean, north through the Aegean, threading through the Dardanelles into the Sea of Marmara and at last encountering the Bosphorus Strait and the bridges that caused all this effort in the first place. The spans sit 64 meters above the water, and according to Bardsley, the Istanbul Port Authority won’t let you cut it too close when passing under.

“The unrestricted limit is 54 meters. However, you can go as high as 58 meters if you have extra tugs and other large vessel traffic is restricted,” he says. “Before we left Palermo we trimmed up a few protrusions and then had a surveying company come out to verify that the rig in its reduced form could safely pass under the bridges. At that point we were good to sail, but it was close. In fact we were slightly too high, but we had a plan. The lift ship ballasted down a couple of meters, which put us at 57.788 meters tall.” Under the *Endeavor* went, with 0.212 of a meter to spare.

With the bridges behind, the lift ship carried on to Constanta. The *Endeavor* was detached just outside of the port and secured with tugboats. After a day’s wait

for fog to clear, the tugs towed her in and tied her off to the quay. Now began the work to do what had been undone in Palermo.

## ROMANIAN RESURRECTION

The sprawling city of Constanta is half seaport, half summer resort. While families frolic in the lapping waves, slurp up fast-melting soft serve, meander through souvenir stands and linger in cafés, a giant rises conspicuously nearby. This is a busy port with large cargo ships routinely coming and going, but the locals have never seen anything like the *Endeavor* before. When she was pulled into port, hordes of onlookers crowded the quay to observe the spectacle, excitedly snapping countless cell phone pictures. Weeks later after the derrick is reattached the rig can be seen for miles around, even from the countryside outside of Constanta. This new oddity on the skyline stands as startling evidence to the lack of deepwater drilling in the Black Sea. But ExxonMobil is in the process of changing all that.

Bardsley says the rig was brought here practically by default. “We had to look for ports that could handle work like this. First you need the water depth to bring something this size in, and then you need the resources to do the work,” he says. “Fincantieri in Palermo is a well-known shipbuilder with a good facility and equipment, which gave us a high level of confidence. Here it was a different story. We did a broad search

around the Black Sea and found that there wasn’t really a single shipyard built to handle a vessel the size of the *Endeavor*. But Constanta did have the required water depth, so we landed here. When we first arrived we pretty much took over all the space. We had the *Endeavor*, the heavy lift ship, our 170-meter cargo ship, a 75-meter barge and the 75-meter floating crane. This is kind of a bare-bones facility without a lot of support. So we hired Harris Pye, a mobile shipyard contractor that we have a long and good relationship with. They mobilized here to work the project.”

The work in Constanta goes on for 88 days. The derrick rises. The deck crane kingposts are welded back on and the booms reassembled. All equipment systems are reinstalled. Every component of the rig is triple checked and inspected. As the departure date nears, a palpable excitement permeates the air, as crewmembers and contractors knock out punch-list details, a process known as acceptance testing. “We make sure everything is ready for ExxonMobil,” says Bardsley. “The rig needs to be 100 percent before it goes offshore. We go through all the systems to verify that everything works the way it was designed to do. So when the rig gets on location, nothing will fail and cause downtime.”

When testing is complete, ExxonMobil gives the green light and the *Endeavor* is carefully pried away from her berth. Compared to the rig’s arrival, the scene on the Constanta quay is considerably

less frenzied when she departs. A few workers in optic orange coveralls scramble over the scaffold stairway, dismantling the only foot access to the rig. A harbor boat peels off the pontoon barrier that encircles the rig and slowly chugs away. The tugs report for duty and hook up for the tow. Gone are the curious crowds. Now just a motley pack of port dogs laze on the quay, watching indifferently as the hulking rig inches away. Dolphins lead the tugs, which in turn lead the *Endeavor* out to sea. One journey at last is complete. The next one begins.

After a brief load-out stop near the port, the rig is towed to the Neptun Block about 100 miles offshore. On July 11th the *Endeavor* at last begins the task it was hired to do so many months ago—drill a well.







## TEAM BUILDING

While this is by far the largest, longest and toughest project Bardsley has ever managed, he's quick to heap the credit on other shoulders.

"It wasn't me who figured this all out. We have a good team of engineers back in Houston that did all the planning and all the nuts and bolts calculations of how to do this. Then we had to work closely with the rig crew to figure out how to make the project actually happen," he says. "Planning and logistics were the toughest part, which began back in 2012. There really were a lot of pieces of the puzzle that had to come together just right. We had to find and synchronize the timing of shipyard facilities, cranes, ships and a lot of different contractors. The planning paid off. We allotted 43 days for Palermo and we pulled out on the 43rd day, we planned 12 days for transport to Constanta, and we pulled in on the 12th day. When you consider how many enormous pieces have to fall in place, these are not easy feats."

At any given time during the height of the project, more than 225 crewmembers and contractors had to be managed as they worked widely varying tasks all over and around the rig. Many of the biggest names in the offshore industry

were key players. NOV sent crews to de- and re-commission the derrick and drilling package, SeaTrax helped get the cranes back up and running, Viking SeaTech changed the mooring wires to prepare for increased water depths, COSCO provided the dry-tow ship, Hansa the cargo ship and Boskalis the floating crane.

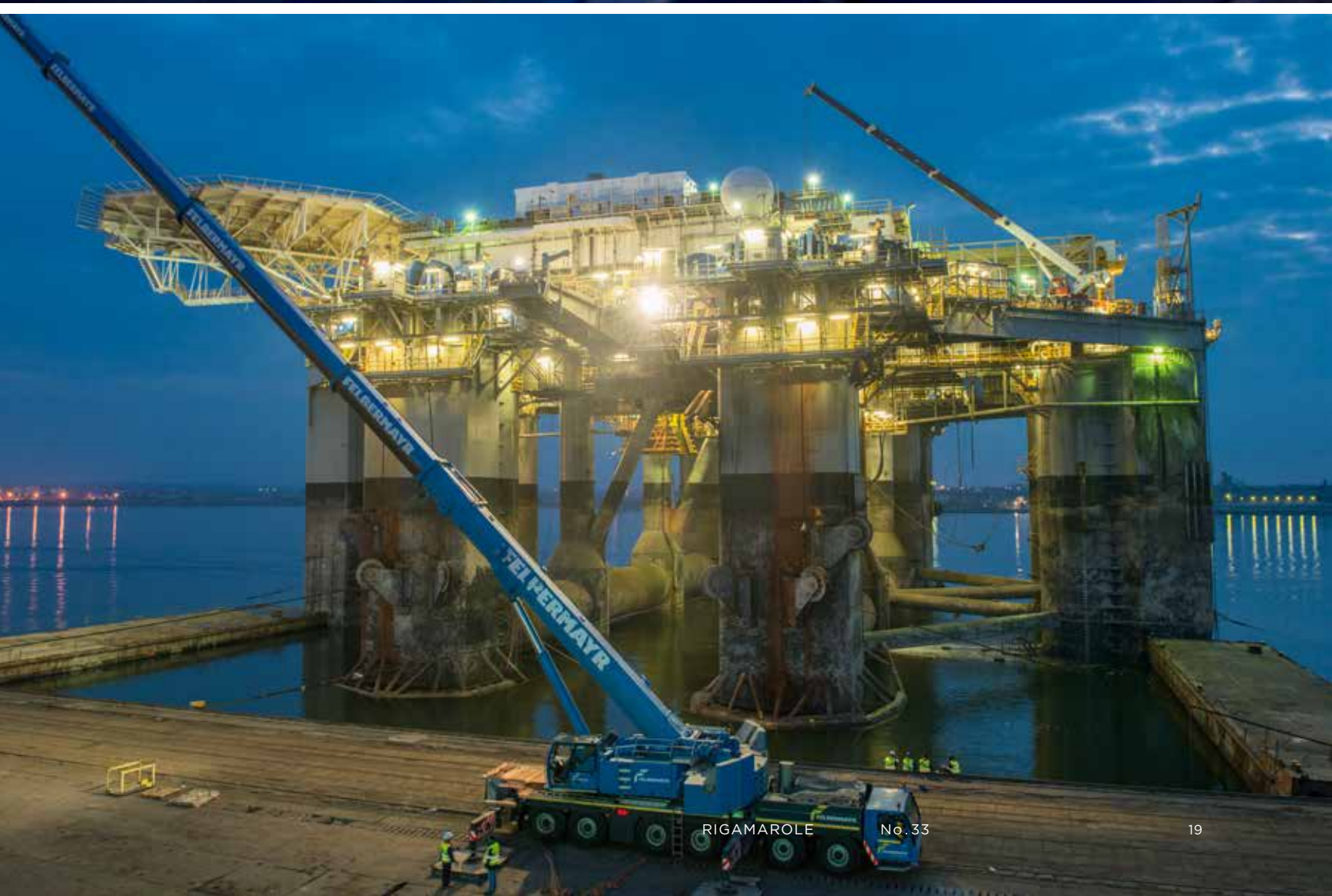
A healthy percentage of Diamond Offshore's own workforce got involved as well, even beyond the *Endeavor's* crew. "After starting the project I was amazed at just how much of the company was involved," says Bardsley. "Of course it starts with the crew, and they have been great to work with. Plus there's the support we get here on the ground in Romania with our operations managers, shorebase materials men, mechanical superintendents and electrical superintendent. And then there's the support we get from Houston. We had help from engineering, accounting, treasury, legal, purchasing, logistics, maintenance, subsea, IT, marine, marketing, HSE, HR, and even help from other rigs on a daily basis. I think every part of the company has given support to this project in one way or another, which really shows that everything we do is a team effort. We all had to come together to make this project a success." This statement, of course, includes the client.

## WORKING WITH XOM

As the largest of the supermajors, ExxonMobil can be highly selective when preparing for a drilling campaign. The company chose to hire the *Endeavor* for many reasons. The rig is well equipped to do the job because it is conventionally moored and has a high static hook load and vast deck space. Furthermore, ExxonMobil had previous good experience using the rig in 2009 in the GOM. But Bardsley says the biggest factor is safety.

"ExxonMobil is a top-notch company. They have the resources and personnel to see a project through 100 percent. They are very thorough in everything they do, and safety is one of their biggest concerns, and one of ours as well," he says. "We have gone through this enormous project without a major incident, and I like to say it's been a result of all the preaching given from both Diamond Offshore and ExxonMobil. The safety culture of both companies melds very well. ExxonMobil's culture is that nobody gets hurt, and Diamond Offshore's is Zero Incident Operations. They go hand-in-hand."

Sam Lujan, ExxonMobil Senior Drilling Superintendent and company man aboard the *Endeavor*, couldn't agree more. "We always start our





day with safety,” he says. “We hold a meeting with the entire crew that’s about to come on shift, discuss what happened in the previous shift and discuss any hazards that have been identified.” Lujan adds that this project calls for an even higher level of diligence because the rig is way out of its element while in port.

“Here in the shipyard we are exposed to hazards that are not commonplace. When we’re offshore, operations are a little more typical. But in port there’s a lot of activity and a lot of different contractors interfacing. There are more hazards that we are not quite used to, so we have to be extremely attentive to safety and really look at the work from a planning standpoint to make sure everything is getting addressed.”

Lujan was with the *Endeavor* on the 2009 ExxonMobil contract and was happy to see the rig come back.

“We know what it’s capable of, and we know the people,” he says. “I would say about 70 percent of the expat personnel are the same, which says a lot about Diamond and their ability to retain good people. Coming back and seeing a lot of the same guys was really a positive. They know how we operate and they know we stand behind our safety vision. It’s good to have that continuity. It was also good to come back and see that the rig is still very

clean. It’s obvious that they take a lot of pride in their operation.”

Senior Lead Drilling Superintendent Mike Morgan is another ExxonMobil company man aboard the rig. He says safety has been achieved because the two companies see eye-to-eye. “A lot of elements of our safety systems are the same. We have actually merged our worksite safety plans. We compared our policies to Diamond Offshore’s, and we have taken the more stringent rule between the two and made it the standard for this operation. Among drilling contractors, Diamond’s safety standards rank very high, and I think their statistics show it.” Morgan says that high standards are also apparent in the *Endeavor*’s appearance. “The rig is very well kept. It gets you excited when you see that people want to do the right thing, and keep their housekeeping up. All rigs are not like that. You can see that it is a culture here.”

Like most others on this project, Morgan is treading new ground. “I’ve never been associated with anything like this, and I would have to say it has gone well,” he says. “When you look at the scope of the work to remove the derrick and cutting down all three cranes and removing all the lines and cables, it’s quite a daunting task. On my first hitch here, they were just starting work on putting things back up. Then I went off for a

couple weeks, and when I got back everything was pretty much in place. You know, that’s really impressive.”

## CHALLENGES SOLVED

As one would expect on a project of this magnitude, not everything has gone to plan. Morgan says there have been some hiccups along the way, but they have been well managed. “When the cranes were taken off in Palermo, one of the booms was damaged and nobody recognized it until the rig got here,” he says. “Diamond turned around a new boom section from Aberdeen, Scotland, in two days.” Lujan adds, “Any time we needed something here quickly, Diamond airfreighted it in to keep things clicking along, and with customs regulations and everything else you have to deal with, that’s easier said than done.”

That’s also barely scratching the surface. If you really want some war stories about dealing with challenges, ask the project manager. Kyle Bardsley says he went into this expecting that things would never go exactly to plan. “If that were the case, I could have planned this project from Houston and I wouldn’t need to be here,” he says. “As much as you do to prevent them, there are always challenges and difficulties. One example was in Palermo when we needed to pump out

the ballast water from our pontoons to lift the *Endeavor* out of the water. Palermo has certain restrictions, so we couldn't just dump our clean ballast water overboard. We actually had to pump it into barges and then into trucks and truck it away for disposal. It turned what should have been a two-week job into a 43-day job, and it took the whole shipyard to complete it. Something that shouldn't be an issue such as removing water turns into a big issue. It put us back a month.

"Another big challenge was learning about customs in Romania. This was our first time to work here, so we had to learn all the ramifications of importing a rig, and how long shipments would be held up for parts and equipment. When you work in a place for many years, you know the system. But here we had to start from scratch and learn everything on the fly. We faced a steep learning curve. It was definitely something we had to overcome quickly."

Bardsley says the first thing he does when new challenges arise is to tell everyone. "No one likes surprises. If there will be an unexpected delay, we tell ExxonMobil immediately because they have to plan their business. They are expecting a set date for the rig to be ready for drilling, so if that changes they need to be able to adjust. There are a lot of things they need to have ready on their end as well, such as wellheads, casing, mud and well-control equipment. Open communication keeps the timing in synch."

Jody Elfert is the Operations Manager for the *Endeavor*. When the project is complete and Bardsley heads home, he'll remain in Romania, making sure the client's needs continue to be met. "ExxonMobil is the largest oil and gas operator in the world. With that comes a lot of pressure to perform," says Elfert. "They want to know everything that's going on. We have to give them the information they require to run their operations smoothly. So if a problem comes up, the best thing you can do is to be up front. We present any problems that have been encountered and then present the solution. That leads to a good relationship."

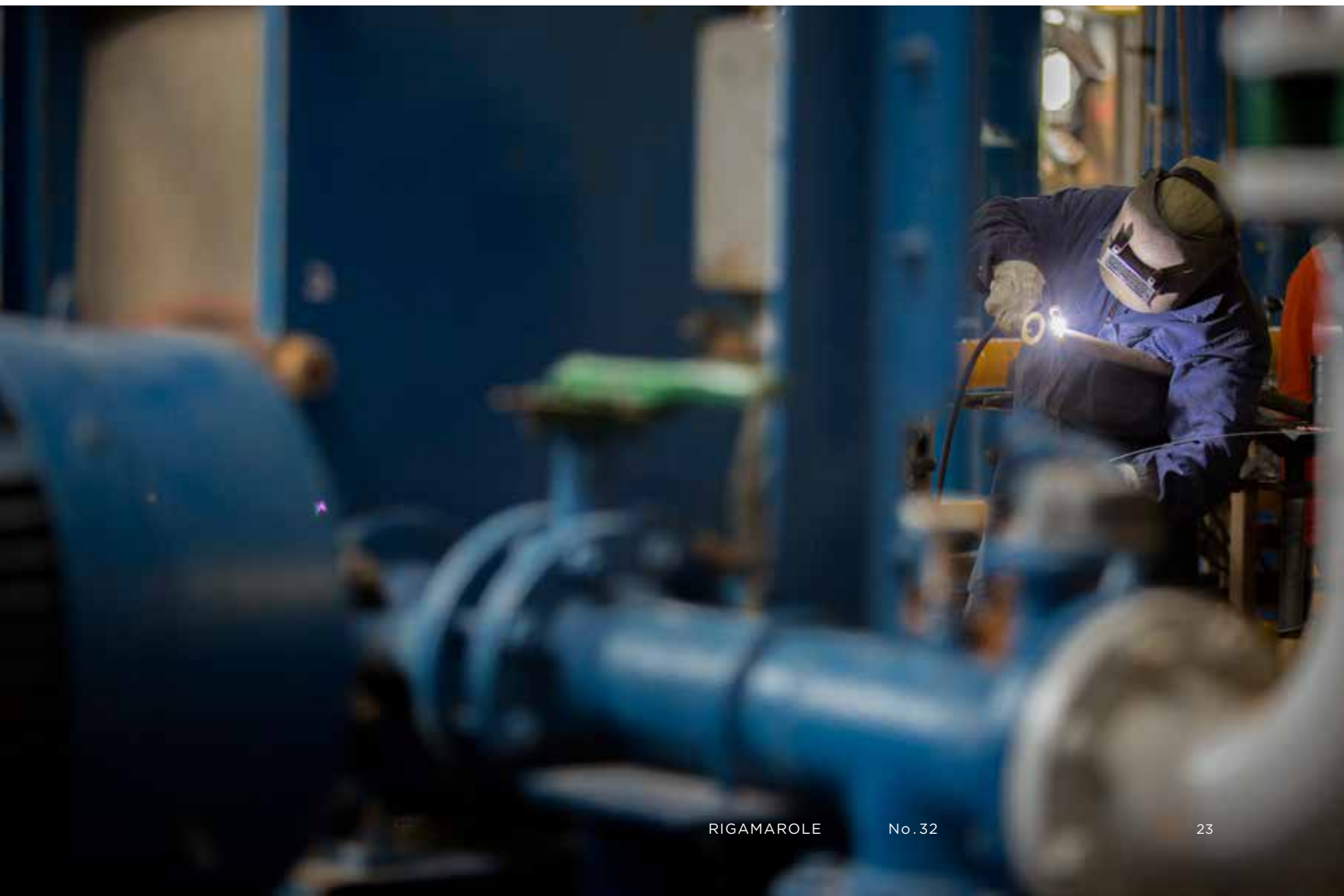
## PREPARING FOR LAUNCH

Before the *Endeavor* could leave the Constanta shipyard, key personnel decisions had to be made. In order to work in Romania, more than half of the *Endeavor's* crew has to be Romanian, and with the lack of deepwater drilling in the Black Sea, experienced people are nearly impossible to find. "We hired a Romanian manning company to help us," says Elfert. "A lot of these guys had never worked in the oilfield. It's a completely new atmosphere for them. Some of them are familiar with ships, but not rigs. So they have been busy learning their way around, getting used to the routine and getting used to working with Americans. Overall it has been a smooth transition. These guys are pretty sharp."

With the new crew aboard and the acceptance testing near complete, Johnny Moore and Randy Suffin eagerly count down the final hours until the rig's departure. They are the Offshore Installation Managers (OIMs) aboard the *Endeavor*, and both admit to getting a little antsy over the last few days in port. Offshore drilling is their natural habitat, and they are more than ready to see a horizon of water in every direction.

"There's a lot more to look over when you're in port," says Moore. "We have contractors who may be just coming onboard for the day, so they are not really as concerned with safety procedures and permits on the rig. It's a big challenge. I walk around all day long verifying that they are doing things to plan. If we see something that's not right, we go over it with them in the safety meeting, and if they still don't do things right we remove them from the rig. Another challenge during this project has been communication. In a very short period of time we have had to communicate in Egyptian, Italian and Romanian."

Suffin adds, "It's just more stressful in port. I'm still responsible for everything that happens on this rig, and there are a lot of people that come and go during the day. That is not normal. When we are offshore I know where everyone is. When we're here, instead of the rig being 350 by 350 feet, it's really the whole shipyard. But I'm still responsible for everyone." Suffin says it will be great to be back offshore, and even better to be







back with ExxonMobil. “They walk the talk, and they do not take shortcuts. I’m really looking forward to this,” he says. “The company men are the kind of guys you can sit down and talk to face-to-face, and that’s how it should be. When you’re working with somebody, there should be no shut doors. For example there have been some delays these last few days that are keeping us in port. Our clients are anxious to get out there and start drilling, but they have said not to rush anything. They said we will do it safely, and it will get done when it gets done.”

“We have very high standards on the *Endeavor*,” Suffin concludes. “Everybody here takes a lot of pride in this rig. That’s how we’ve achieved the safety record we have for all these years. And so the biggest challenge is to get the new people to fall in line with how we work.”

Moore says the first well is going to go a little slower than usual, by necessity. “We will be doing a lot of training on that first one. ExxonMobil is completely on board with this. There is a lot of high-tech equipment to learn. Most of the Romanians speak English, but we also have a translator on board just in case. We want to make sure they really understand the job before they do the job.”

## DRILL AWAY

ExxonMobil has contracted the *Endeavor* for 18 months with an extension option. Kyle Bardsley says the expectation is that the rig will be here even longer. “Some of these guys are hoping that when they retire, they will still be working in the Black Sea. It was a lot of work to break down the rig and get it here, and we would have to go through all of this again in reverse to get it out of here.”

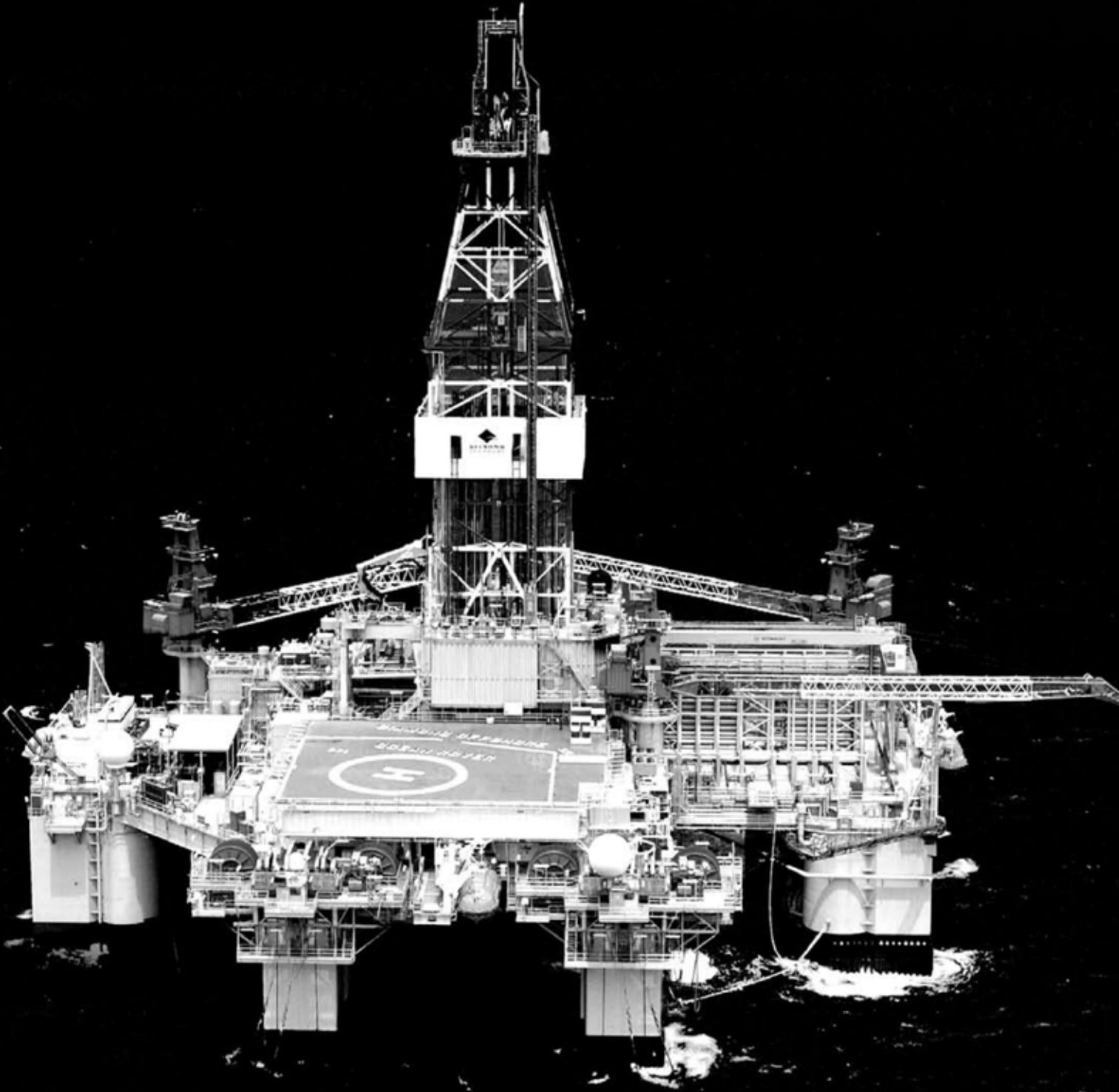
Bardsley runs down the long list of investments made to complete this project. “The floating crane, heavy lift ship, cargo ship and rig winterization were big ticket items. And then there are a lot of other little pieces that add up very quickly.”

Case in point—huge metal racks had to be fabricated to securely hold the derrick and crane pieces on the cargo ship. Diamond Offshore will stash these racks at the Constanta port, just in case the *Endeavor* ever leaves the Black Sea and the disassembly process has to be repeated. But for now, the *Endeavor* drills.

Bardsley’s visa expired almost to the day that the *Endeavor* departed Constanta, yet another finely executed

scheduling feat. He muses over the many cultures he encountered while using that visa. “It was amazing just the diversity of people involved with the project. We had Italians, Dutch, Thai, Germans, Chinese, Romanians, Turks, English and Americans.”

For now he will return to more familiar surroundings, his home in Houston, Texas. “This is by far my largest project,” he says. “Before this my longest project took about 50 days. It’s been long, but it has been rewarding and a good adventure along the way. Now it’s time to go back to Houston, get a haircut and hopefully relax a little bit.”



ORIGINAL PUBLICATION *SPRING 2005*  
WRITTEN BY *JOANN STONE*

*Ten years ago, Diamond Offshore's approach to fleet building was much as it is today. The company looks for the best opportunities to upgrade and renew its inventory. Sometimes that means building new rigs, but often it means building more value into current assets to quickly ad-*

*dress market demands. This article from our first issue finds Diamond Offshore finishing major upgrades on several semisubmersibles—elevating those units to 4th and 5th Generation capabilities, and growing the fleet to the one of the largest deep-water drillers in the world.*

# A FLEET TO MATCH THE MARKETS

**WHY UPGRADING OFFSHORE DRILLING RIGS MAKES SENSE**

# “THE HUMAN ELEMENT IS THIS COMPANY’S GREATEST COMPETITIVE EDGE. WE KNOW HOW TO FIND, TRAIN, AND KEEP GOOD PEOPLE. ...

We always seem to want the next new thing, yet we often complain that “they just don’t build ‘em like they used to.” With offshore drilling rigs, much as with ancient sailing ships, the age of a rig is only one determinant of lifespan, and not necessarily even the best. The original quality that went into the rig’s design and fabrication, along with maintenance and the unit’s current technical capabilities are all critical factors.

With the demand for oil growing, the pressure to find more hydrocarbons is rising correspondingly. Furthermore, as depletion of the world’s more accessible reservoirs accelerates, so does the importance of efficiency in finding and developing new reserves, especially in deeper waters.

With exploration accounting for as much as 25% of the cost of a barrel of oil, energy companies are looking for ways to lower their discovery and development costs.

Diamond Offshore made a decision in the mid-1990s to be aggressive about getting the most out of the Company’s drilling fleet. “We sensed then that there was a severe shortage of deepwater drilling rigs,” says Larry Dickerson, Diamond Offshore’s President and Chief Operating Officer. “So we decided that we could upgrade certain rigs within our fleet to add deepwater capacity.”

“The human element is this Company’s greatest competitive edge. We know how to find, train, and keep good people. After that, the focus comes down to our fleet. How flexible and efficient are the rigs? How deep we can go? How quickly we can deploy a unit? How competitive are our drilling rates?”

The majority of Diamond Offshore’s fleet was built through acquisitions and mergers with other drillers. In some cases, like the *Ocean Vanguard* and the *Ocean Patriot*, the Company purchased rigs on a stand-alone basis. While many of these units were built in the ’70s and ’80s, Diamond Offshore believed that because of their structural integrity they would be excellent candidates for upgrading.

So, the Company began a process of modernizing the fleet on a rig-by-rig basis, as their pedigree and condition dictated. “From a cost and a time standpoint, we believed that 4th and even 5th Generation capabilities could be achieved for about one-half the cost of a new-build rig, and that the rigs could be operational in less than half the time.”

“We are talking about maximizing the full potential of our fleet,” explains Rodney Eads, Senior Vice President of Operations, “in order to provide customers the technical capabilities they require to operate in deep water and drill to deeper total depths.”

## **BEGIN WITH THE BEST**

Between 1996 and 2004, Diamond Offshore conducted major upgrades on more than one third of the Company’s rigs. As a result, Diamond Offshore has gone from a fleet of predominantly intermediate depth semisubmersibles to having the second largest deepwater fleet in the industry.

The Company’s 14 jackup units were also modernized. Seventy-five percent can now drill in 300 feet of water or greater, and all but one have cantilever packages. Both the *Ocean Titan* and *Ocean Tower*, which operate in water depths up to 350 feet, were converted from independent-leg slot rigs to independent-leg cantilever rigs. Of the semi-submersible upgrades, over half involved enhancing Victory Class rigs built in the 1970s.

The Victory Class rigs were chosen because, says Eads, “Victory Class rigs have a unique geometry. They consist of four pontoons, four horizontal cross-tubes, diagonal braces, 12 columns, and a cruciform-shaped deck. They were built with thicker and higher quality materials, and expansive deck space. In other words, they were built with a good bit of reserve strength, possess sufficient size, and have excellent fatigue and motion characteristics. This makes them ideal candidates for the generational adaptability of the kind Diamond Offshore has been doing.

# ...AFTER THAT, THE FOCUS COMES DOWN TO OUR FLEET. HOW FLEXIBLE AND EFFICIENT ARE THE RIGS? HOW DEEP WE CAN GO? HOW QUICKLY WE CAN DEPLOY A UNIT? HOW COMPETITIVE ARE OUR DRILLING RATES?"

"When the Victory Class rigs were first built in the 1970s, they were capable of drilling in 600 feet of water. In the 1980s we increased their water-depth capabilities to 2,000 feet, and in the 1990s, beginning with the *Ocean Voyager*, to 3,000 feet," says Eads. "With the modernization of the *Ocean Baroness* and *Ocean Rover*, we've taken them to 7,000 feet and provided true 5th Generation capabilities," adds John Vecchio, Senior Vice President of Technical Services. "And we are capable, with additional mooring, and other more minor adjustments, of taking them even deeper."

"The Victory Class upgrades fundamentally involve stripping the rigs down to their basic hulls, then augmenting the hulls and outfitting the unit with modern equipment. When Diamond Offshore started this program, we heard some in the industry say that the level of modifications we were planning could not be done cost effectively. We did not agree. If you have selected your rig right, the heart is still good," Vecchio continues. "Performing normal and consistent maintenance has a lot to do with lifespan. With the Victory Class rigs, the shortest calculated fatigue life for the steel in the hull is 84 years, with others running into the 200-year range."

"Most of the time, equipment simply becomes outmoded," Vecchio explains. "And of course, drilling in deep water requires more robust systems. But that doesn't mean that you have to start from scratch."

## WHAT AND HOW

"Our approach, basically, has been two-pronged," Vecchio continues. "In several instances, the modifications were made to suit specific drilling programs for our customers. Both the *Ocean Quest* and *Ocean Confidence* fit into that category. In other cases, such as the *Baroness* and *Rover*, we have tried—successfully—to anticipate the market and modified rigs based on our assessment of what the marketplace needed—both near and longer term."

"Of the major Victory Class upgrades, costs have ranged from a low of \$10 million for the *Voyager* to a high of \$188 million for the *Rover*," says Vecchio. This compares with over \$400 million for a similar new-build rig."

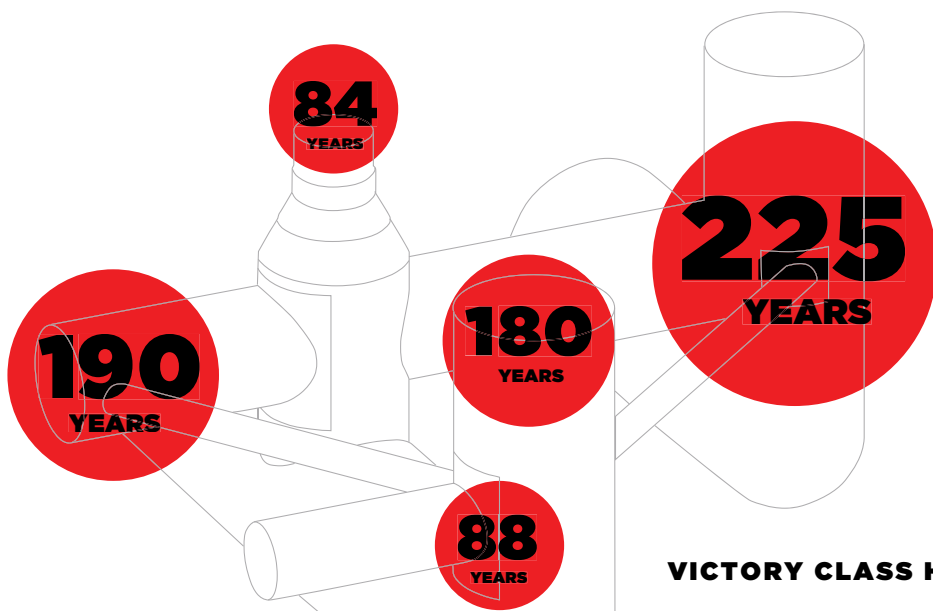
"In terms of complexity, the *Confidence* was the most challenging, due largely to the degree of automation required. The *Confidence* incorporates a Dynamic Global Positioning System capable of keeping the rig on station within 1–2 feet, 90% of the time. It can drill in 7,500 feet of water. And the unit can

operate in extreme environments like those off the coast of Norway."

"With both the *Rover* and *Baroness*, we wanted rigs that could drill deep wells in deep water," Vecchio explains. "Just as important to the program, however, we wanted to ensure that they were efficient, dependable developmental drilling tools, capable of evaluating and completing wells successfully at these greater depths. And we wanted to be able to enhance them even more as technology and customer needs warranted."

The two units are virtually identical Victory Class rigs, as originally built in 1973, and now as upgraded to 5th Generation status in Singapore, beginning with the *Baroness* in late 2000. The *Baroness* upgrade was completed in 19.5 months and the *Rover* in just over 20 months. Both upgrades came in under budget estimates.

Water depth capabilities for both rigs were increased from 1,500 feet to over 7,000 feet as outfitted. Drilling depth was taken from 20,000 feet to 35,000 feet. Variable deck loads more than doubled, and riser tension increased almost five times, from 640 kips to 3,600 kips. Mud and completion fluid storage capacity more than quadrupled. And crew quarters were expanded to accommodate approximately 50% more personnel.



**VICTORY CLASS HULL FATIGUE LIFE**

The primary features that were upgraded to enhance developmental capabilities for the *Rover* and *Baroness* included large moon pools, high-capacity tree handling systems, offline activity capabilities, large deck areas and greater variable deck load capacity. Additional mud and completion fluid storage was also provided.

**RESULTS IN THE WATER**

Speaking to the American Association of Deepwater Engineers last year, Mike Sprawls, Drilling Manager for Unocal Gulf of Mexico, said, “Operators don’t want a rig, they want the result of utilizing the rig.” Results for operators are what Diamond Offshore’s upgrades have been producing.

When Murphy Oil Corporation contracted the *Rover* to drill two wells on one of its leases in deepwater offshore Sabah, Malaysia, the company did so with options to drill additional wells within its Sabah lease. Since commencing drilling operations in July 2003, the *Rover* has drilled a total of 12 wells in water depths ranging from 377 to 5,729 feet. This has enabled Murphy to move quickly from location to location, amid numerous discoveries, with the flexibility to formulate development plans and return to the most promising wells in a timely manner. Across the island of Borneo in the Straits of Makassar,

the *Baroness* is providing Unocal the ability to quickly swap from surface to subsea is blow-out prevention systems in deep water as the company seeks to extend the life of Indonesia’s East Kalimantan field.

**FLEXIBILITY FOR THE FUTURE**

“In total, we have spent an estimated \$1.1 billion over a period of eight years to create the second-largest floater fleet in the world, a fleet capable of drilling anywhere in the world,” says John Gabriel, Senior Vice President of Contracts and Marketing.”

“We have become very proficient at doing these modifications, at accurately projecting the costs and timeframes and putting together the teams to achieve the results we want. As long as the return on investment is there, we will consider doing them. Does this mean we will never buy or build new rigs? No. We will evaluate every opportunity that makes us more competitive.”

“The company’s long term strategy of upgrades has delivered results both in terms of fleet enhancement and shareholder value,” says David Williams, Executive Vice President. “Our fleet has been completely transformed from predominately 2nd Generation units to one of the largest collections of deep water rigs in the world. We have successfully moved rigs from

the low end markets to higher spec markets, which has enabled us to compete in the new frontiers offshore and has reduced the available supply in the shallow water fleet. This has improved the market dynamics for both classes of rigs.”

“We have accomplished this aggressive repositioning largely during slack market periods, using non-performing assets which has reduced our lost opportunity for upgrade candidates and put us in a stronger position in dealing with shipyards and suppliers. This overall strategy has allowed us to deliver a highly evolved fleet capable of competing in the most challenging applications at a fraction of new build costs.”

“Our fleet transformation is now beginning to pay huge dividends. We have been on the front lines of the most recent market movement and are well positioned take advantage of the opportunities and challenges ahead.”







ORIGINAL PUBLICATION *SPRING 2005*  
WRITTEN BY *MICHAEL SLATON*

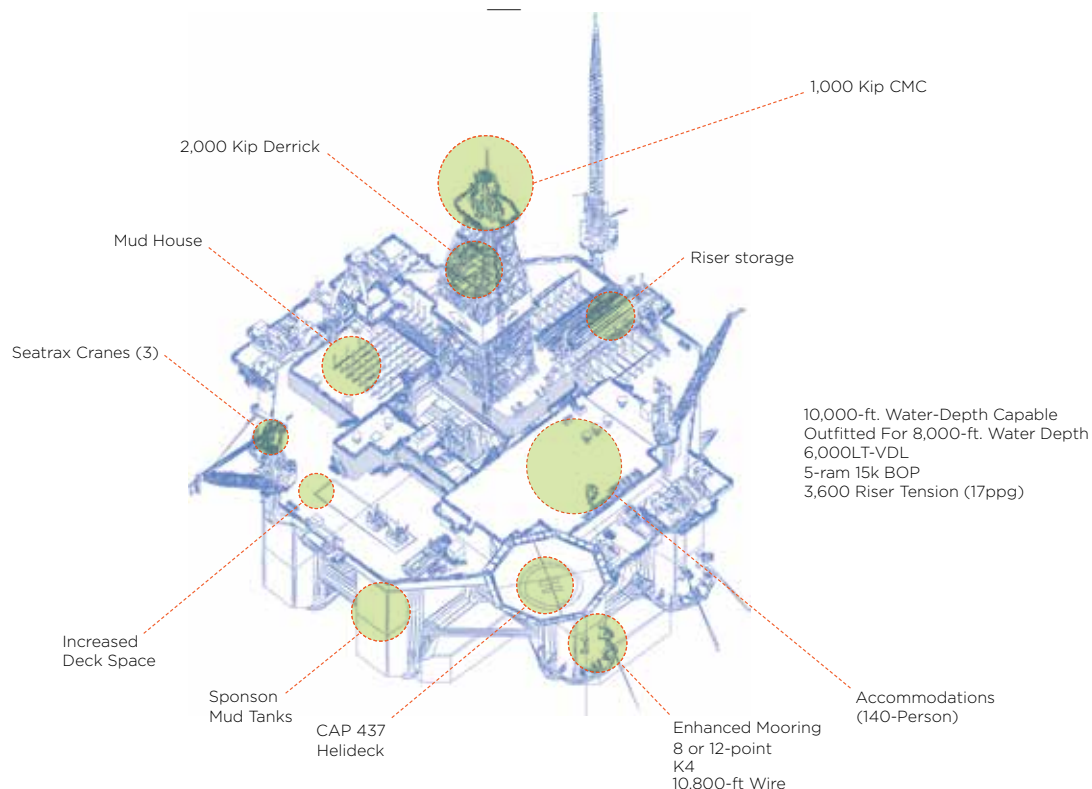
*When you place our current feature article next to this one from 2006, you can see that the Ocean Endeavor has long had the goods to play a starring role in Rigamarole. This story takes us to Keppel FELS shipyard in Singapore, where the Endeavor is nearing the end of an*

*upgrade to ultra-deepwater status. Diamond Offshore saw rising demand for rigs that could drill in waters up to 10,000 feet and precious few units in the world that could pull off the task. The Endeavor exited Singapore as one of the most desirable rigs on the market.*

# ULTRA-DEEP ENDEAVOR

ARRIVAL OF THE *OCEAN ENDEAVOR* AT KEPPEL FELS SHIPYARD IN SINGAPORE MAY 20, 2005, MARKED THE BEGINNING OF A TWO-YEAR UPGRADE THAT WILL PREPARE THE SEMISUBMERSIBLE FOR SERVICE IN THE WORLD'S GROWING ULTRA-DEEPWATER DRILLING MARKETS. WHEN THE \$255 MILLION ALL-IN-COST PROJECT IS COMPLETE, THE RIG WILL BE ONE OF THE LARGEST AND MOST CAPABLE IN DIAMOND OFFSHORE'S FLEET OF DEEPWATER SEMI-SUBMERSIBLES AND ONE OF THE MOST SOPHISTICATED DRILLING UNITS IN THE WORLD.

## OVERVIEW OF THE UPGRADES



Like the previously upgraded semi-submersibles *Ocean Rover* and *Ocean Baroness*, the *Ocean Endeavor* is a Victory Class rig, a stout design distinguished by a cruciform configuration with four hulls and 12 columns, that lends itself well to 5th generation conversion. However, the *Endeavor* upgrade is even more ambitious than the *Rover* or *Baroness*.

Upgraded by Keppel Fels in 2002 and 2003 respectively, the *Baroness* and the *Rover* are outfitted for working in water depths as great as 7,000 ft., though up to 9,500-ft. water depths can be achieved utilizing augmented moorings and additional riser, buoyancy, casing and drillstring. With increasing market demand for 7,500 ft. and greater water depth capability, the *Endeavor*, initially outfitted for operations in 8,000 ft. of water, will be capable of operating in water depths of up to 10,000 ft. using augmented moorings. Additionally, the *Endeavor* mooring system will be easily upgradable to a 12-point mooring system.

The fully modernized *Endeavor* will expand Diamond Offshore's 5th-

generation semi fleet to four units, and the Company's fleet of rigs capable of operating in 3,500 ft. of water or greater to 13, compared with three in 1995. Estimated cost of the *Endeavor* upgrade is significantly below today's new-build cost of up to \$500 million dollars. In addition, the relatively short construction schedule represents a large delivery advantage over new builds.

A similar upgrade approach may also be applied to the Garden Banks. An agreement to acquire the semisubmersible, also a Victory Class design, was announced in April while the *Endeavor* was being transported to Singapore. When the acquisition is completed, Diamond Offshore will own all nine of the world's Victory Class hulls.

When the *Endeavor* was built in 1975 at Transfield Shipyard in Fremantle, Australia, the new semi was rated for 600-ft. water depth. Changing the rig into a modern-day, 10,000-ft. deepwater behemoth is a carefully orchestrated process honed by Diamond Offshore's long experience with Victory Class upgrades. The rig is the sixth Victory

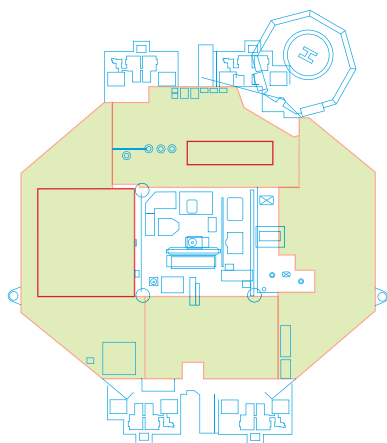
Class modernization project in a Company history that also includes the *Ocean Quest*, *Ocean Victory* and *Ocean Star* rigs in the mid-1990s, and has its origins in Victory Class work that extends back to the 1970s.

"Knowing what you're getting into and where you're going is a big advantage," says John Vecchio, Diamond Offshore's Senior Vice President of Technical Services. "Time spent up front eliminates mountains of time off the back end," he says. "Having a mature design with real costs is essential to the decision to build and the success of the project."

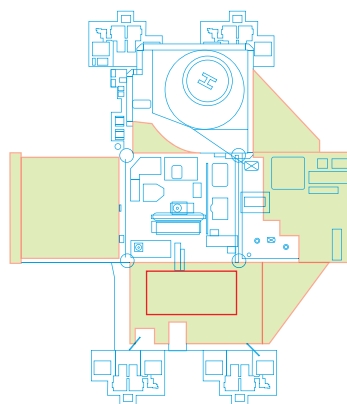
The approach earned strong credibility in earlier upgrades. The *Baroness* and *Rover* upgrades hit delivery schedules and target costs "almost exactly," says Vecchio.

The upgrade process for the *Endeavor* began while the rig was cold stacked at Sabine Pass, Texas. The decision to proceed was announced in early January 2005. By March 28, when the semi was loaded aboard the Blue Marlin for the dry tow to Asia, the project was moving

## USABLE DECK SPACE



OCEAN ENDEAVOR 51,611 SQUARE FEET



OCEAN ROVER 27,523 SQUARE FEET

### A COMPARISON OF THE ENDEAVOR AND ROVER

on many fronts, all converging on the Singapore shipyard.

Coordination of multiple suppliers and vendors is a key skill in a complex scheduling process that involves dozens of primary vendors and hundreds of suppliers overall, says Karl Sellers, Vice President and second in command of Technical Services, who sums it up succinctly with the dictum, “Careful planning avoids critical path problems.”

By the time the rig set off for Singapore, most major equipment had been ordered and steel was being received at the yard. Arrival of the rig is one of many milestones that include contract signing, cutting first steel, dry-docking, main generator commissioning, drill-floor erection and outfitting, and successful completion of commissioning.

The actual upgrade begins with equipment removals and demolition. Vecchio compares it to remodeling a house when he says, “First you strip away as much as you can and still retain structural integrity.” Then the foundation work begins. The focus here is on adding

bigger column and pontoon spousons to the hull. These changes will add the buoyancy needed to support the heavier loads of equipment required for deep development operations and also provide capacity for high-volume mud storage. The planned 16,000 bbl fluids-handling capacity of the *Endeavor* overshadows even the considerable 13,800 bbl capacity of the *Baroness*.

Activity on the rig is paralleled at quay-side, where major “blocks” of the rig, such as living quarters, are built and lifted into position. These steps require careful integration of suppliers and the shipyard, says Sellers.

For instance, equipment suppliers must coordinate with the electrical system SCR supplier so that power requirements are understood. These suppliers must further coordinate with the shipyard on the installation of equipment and running of electrical cables.

The scope of the *Endeavor* upgrade is big even when compared to the considerable changes made on the Rover and Baroness. In addition to greater depth capacity, the *Endeavor*

upgrade will add more capability across a broad range of specifications responding to customer needs in deepwater development. These changes will enhance drilling and completion capabilities as well as the rig’s operational window and ability to work for extended periods with reduced support requirements.

Increased materials storage and handling capabilities central to the upgrade of all three rigs are driven by the larger, heavier tubulars used in deepwater completions. “Greater storage on the rig,” explains Vecchio, “shortens the logistical supply train and makes the operation less boat-dependent. We can stage from the rig rather than the beach.” For example, *Endeavor* will have a 6,000-long-ton operating variable deck load (VDL). This allows for a full complement of tubulars, fluids and stores onboard—a logistical advantage in extended operations. In contrast, the Baroness and Rover have a 5,500-long-ton operating VDL. Additionally, free deck space, also important to materials handling and storage, has been greatly expanded. Along with the larger spousons, the



added deck space is one of the more visible aspects of the change the rig will undergo. The *Endeavor* will offer an impressive 50,000 sq. ft. of free deck space—more than double the 23,000 sq. ft. available on the *Baroness*.

Deepwater development operations are supported by a full complement of customer and service company personnel. The *Endeavor* upgrade expands accommodations from the 122-person permanent quarters on the *Rover* and *Baroness* to

quarters for 140 personnel and significantly increased office space. Like the *Rover* and *Baroness*, the *Endeavor* will also feature enhanced developmental capabilities including a large moon pool (25 ft. x 90 ft.), a high-capacity tree handling system, and additional mud and completion fluid storage capacity.

In addition, the rig will employ the same Tripsaver™ technology that is at work on the *Rover* and *Baroness*, which provides for significant drilling

efficiencies. The offline capabilities afforded by the technology provide operators with the flexibility to carry out multiple tasks without interrupting primary drilling activity, including setting aside the BOP to save a trip in subsea tree installations, and suspension of casing in the moon pool while running anchors.

Other non-Tripsaver™ offline capabilities include:

- Making-up and laying-down drillpipe during drilling operations



1,500 kips of setback while transiting, allowing drillpipe make-up and setback while underway

Picking up drillpipe while drilling  
Preparing tools while drilling

Making up shoe, float collar and centralizers to casing joints

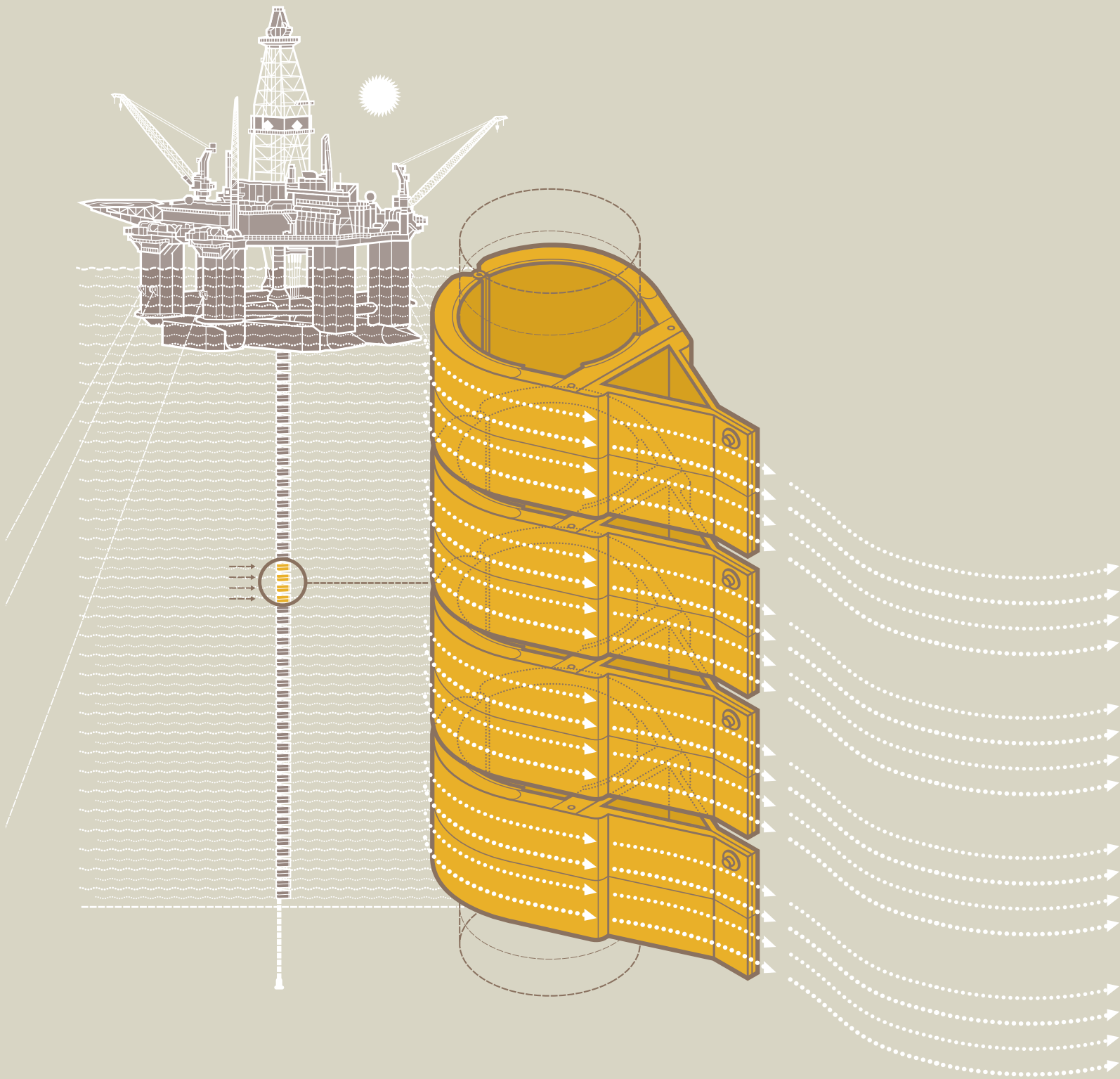
Larger pipe and greater hydraulics used in development operations also increase fluid and pump requirements. Along with greater mud storage volume provided by the larger structural

columns, the Victory Class upgrades add greater hydraulics with increased pump capability. The *Baroness* is equipped with three 2,200 hp mud pumps and a dedicated 1,700 hp pump for the riser. The riser boost pump ensures well requirements are met while still being able to return heavy cuttings and mud to the surface.

The *Endeavor* will have an even greater capability with four 2,200 hp pumps.

Other distinguishing features include a 5 ram, 15,000 psi BOP; 9,450 ft. of

riser storage; and 21,900 cu. ft. of bulk storage capacity. The modernization of the *Endeavor* follows a long history of upgrading Victory Class rigs to meet customer's evolving needs for deepwater applications. With demand for deepwater equipment increasing, the Garden Banks appears poised to follow.



#### GOING WITH THE FLOW

Riser fairings allow the Loop Current to slide around the drillstring. Each segment can swivel independently, ensuring the fairing is always aligned to the current.

ORIGINAL PUBLICATION *SPRING 2006*  
WRITTEN BY *SCOTT REDEPENNING*

*No matter where in our watery world operators want to drill, Diamond Offshore will find a way to take them there. This article dives into the deepest recesses of the Gulf of Mexico, where the notoriously treacherous Loop Current threatens rigs, risers and regular drilling operations. E&P companies are enticed into these waters to capitalize on the promise of large hydrocarbon deposits, and Diamond Offshore is helping them contend with the current and tap the reservoirs through technology, strategy and deft station keeping.*

# TAMING THE LOOP

RAGING OFFSHORE RIVER. STORM SUPERCHARGER. RIG WRECKER. THE GULF OF MEXICO'S (GOM) INFAMOUS LOOP CURRENT HAS EARNED SOME NEFARIOUS NICKNAMES. BUT SIGNIFICANT OIL AND GAS RESERVES LIE DEEP IN THE OCEAN FLOOR BENEATH THE LOOP. AND WITH FAVORABLE COMMODITY PRICES AND ESCALATING WORLD DEMAND FOR HYDROCARBONS NUDGING OPERATORS INTO DEEPER WATER IN SEARCH OF HARDER-TO-REACH RESERVOIRS, THE GULF'S LOOP CURRENT IS ONE OF THE MORE POWERFUL FORCES OF NATURE WITH WHICH THE INDUSTRY MUST RECKON.

“We deal with ocean currents all over the world, but none are more complex and challenging than the Loop Current,” says Rodney Eads, who heads worldwide operations for Diamond Offshore.

Bob Blank, an area manager of domestic operations in the GOM adds, “We are going off the continental shelf and more and more toward the Loop Current.

Our customers want to be out there, and some of them are shocked the first time the Current hits them.”

The Loop Current is a finger-shaped “river” of unusually warm and fast water moving clockwise into the GOM at the Yucatan Peninsula and back out at the tip of Florida. This oceanic anomaly can push 80° F water hundreds of feet deep. The Loop packs a potent punch of having heat energy coupled with the raw power of the fast moving water, which has led to some notable impacts. First, the Loop Current creates ideal conditions for the growth, transport and retention of *Gymnodinium breve* blooms,

more commonly known as Red Tide, which kills massive numbers of fish and causes severe respiratory problems in humans. Additionally, the current has a supercharging effect on tropical storms and hurricanes. And finally, even without storm activity, the Current can wreak havoc on semisubmersible rigs conducting offshore drilling operations.

This last point is exacerbated by unpredictability. The Loop Current is amorphous, constantly changing length, width, shape and even depth. Gigantic eddies known as warm-core rings, are spun off and carry Loop Current effects to other areas of the GOM before dissipating. All this means that Loop Current conditions can migrate in and out of a rig’s position with very little warning, and can be at any level in the water column below the rig at any time.

These conditions create unique challenges to deepwater drilling in the GOM. The riser, which encases the drill string for thousands of feet from rig to

wellhead, is of particular concern. Much like fishing line bows in the slight current of a stream, the riser is subject to applied forces of moving water. Strong currents create vortices around the riser—forces in which the pressure on the up-current side of the pipe is greater. This causes vortex-induced-vibration (VIV), which can severely stress the riser joints and damage subsea structures and the wellhead. Extreme cases have even caused the riser to part from the rig and sink to the sea floor. Blank notes that in addition to the VIV impacts, the Loop Current creates other challenges. “First, getting the rig into position is difficult. So is holding the position. And once lost, getting the position back is hard.”

“Station-keeping in the Loop Current is key,” adds Eads. “On moored rigs, when forces on the moorings are out of our operating window, we have to suspend operations and unlatch the riser. This is costly for the operator.



The same thing can happen on dynamically positioned rigs. When forces exceed thruster power, this can lead to an emergency unlatch, which obviously suspends operations.”

“Timing is the key,” Says Captain Peter Bamber, who directs marine operations for Diamond Offshore. “If conditions force us to disconnect the riser and suspend drilling, we want to conduct a planned operation.” Bamber says that even as current speed mounts, operators don’t want to disconnect while they’re in the drilling window. On the other hand, waiting too long can lead to even more expensive losses. “When water speeds start to exceed two knots, you want to have a plan in place to pull the riser while you still can,” says Bamber. “Otherwise the riser may be lost.”

Fortunately, these challenges are not insurmountable, says Eads. “Diamond Offshore is putting procedures in place to protect the Company’s rigs and equipment, and to protect our

customers’ investment by widening the drilling window.”

### **PUSHING UPSTREAM**

Still, because suspension of drilling at a particular location due to the Loop Current is not uncommon, sometimes for weeks at a time, operators have been forced to look for alternatives. Some have created contingency plans for alternate drilling locations during high Loop Current activity. Yet many are meeting the force head-on with two of the most powerful weapons known to man—knowledge and creativity.

New knowledge is coming in the form of extensive data, which is constantly being gathered, compiled and meaningfully reported. Metocean data correlates meteorological and oceanographic conditions such as water speeds and directions, water temperatures, wind speeds and directions, even cloud height at locations throughout the Gulf. Since 2004, the Minerals Management

Service has required all rigs to collect and share these measurements publicly. Private subscriber services also provide real-time, trend, and forecast reports, so operators can see what’s coming and take the appropriate actions.

These actions come from an array of creative options for mitigating the Loop Current forces on rigs. Moored semisubmersible rigs can be set up with the moorings pre-biased against the current, and occasionally tugboats can be employed to pull a moored rig against the current with just enough force to help maintain station. A dynamically-positioned semisubmersible drilling rig’s thrusters can also be used to counter the force of the current.

Another way to reduce stress on the riser is to use the current’s own force against it, with attachments known as riser fairings. These teardrop-shaped devices divert current around the riser, equalizing forces on all sides to minimize flex and VIV in higher currents.

# “RUNNING FAIRINGS WITH THE RISER COSTS MORE, BUT WE FEEL WE ARE AT THE POINT IN THE GOM THAT WE NEED TO EMPLOY THE FAIRINGS TO HELP CUSTOMERS IMPROVE OPERATIONAL EFFICIENCY AND COST EFFECTIVENESS.”

Diamond Offshore has successfully employed fairings in other parts of the world. Eads says, “Running fairings with the riser costs more, but we feel we are at the point in the GOM that we need to employ the fairings to help customers improve operational efficiency and cost effectiveness.”

## **STORM SURGE**

The Loop Current also plays a major role in the development of hurricanes. Understanding the Loop Current is one of the keys to understanding what these storms are likely to do once they enter the GOM. The Loop Current sits dead center in the Gulf’s hurricane alley, acting as an enormous storm fuel injector. When hurricanes move over the Gulf’s deep, hot waters they can intensify from a Tropical Storm to a Category 5 hurricane in less than 48 hours. This was the case with Katrina. Making matters worse, the

Loop Current at that time had migrated significantly north and west, stretching all the way to the Mississippi delta. Like a runaway freight train, Katrina rode that heated track to landfall, gaining speed and strength until smashing the Gulf Coast with major destructive force.

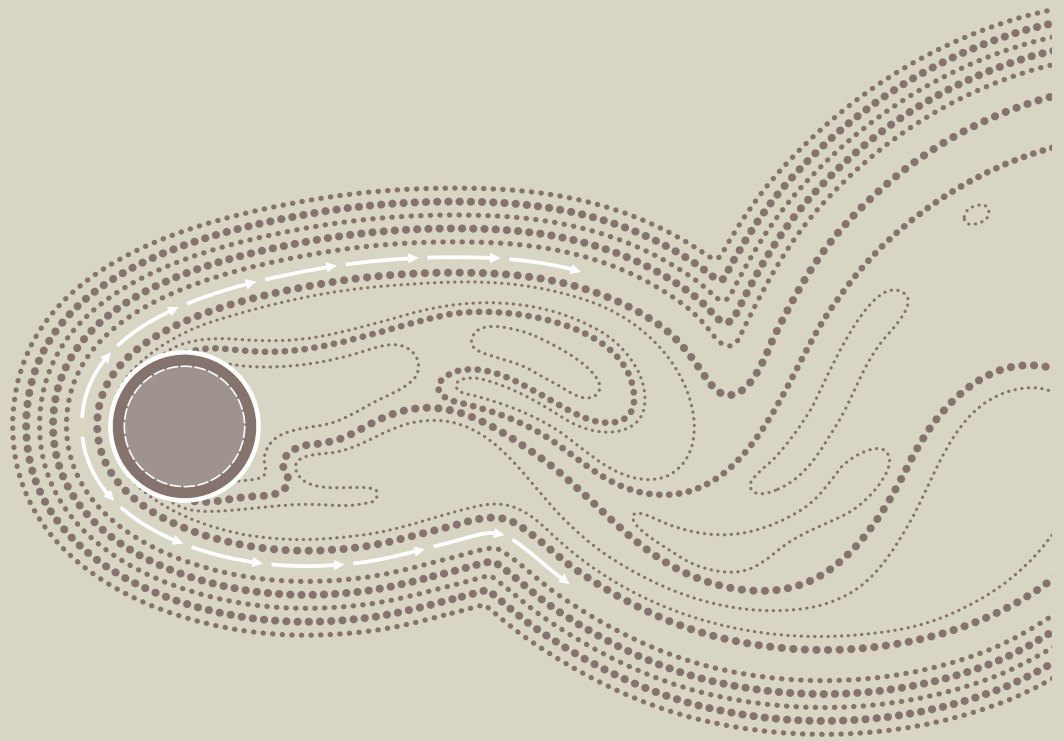
By contrast, Rita gathered massive strength on the Loop Current, becoming the second strongest storm ever recorded. But when Rita moved off the warm rings, the storm lost intensity before landfall.

And, after devastating the Yucatan, Wilma cut easterly across the Loop Current so quickly there wasn’t enough time to intensify before going ashore in Florida.

Hurricanes, 10,000-ft. water depths and the Loop Current, to name a few of the challenges. Paraphrasing Jeffrey Winters, Associate Editor at

*Mechanical Engineering Magazine:*

“If you stop and think about what these rigs do, offshore drilling ought to be impossible. The weather is difficult, depths are so great, and the pipes are so relatively insubstantial that almost a miracle is required to be successful. Imagine trying to poke holes in the ground with a 50-ft. length of ¼-in. wooden doweling. Offshore drilling is something like that. Except worse.” Still, offshore drilling is moving ever farther into the deep and stormy waters in the heart of the Loop Current, and Diamond Offshore is taking steps to make sure the Company can keep “turning to the right” for its customers as safely and efficiently as possible.



### TAMING THE LOOP

These teardrop-shaped fairings divert current around the riser, equalizing forces on all sides to minimize flex and VIV in higher currents. Diamond Offshore has successfully employed fairings in other parts of the world and plans to begin using them in the Gulf of Mexico.

### BAD VIBRATIONS

Strong currents create vortices around the riser—forces in which the pressure on the up-current side of the pipe is greater. This causes vortex-induced-vibration (VIV), which can severely stress the riser joints and damage subsea structures and the wellhead. Extreme cases have even caused the riser to part from the rig and sink to the sea floor.





ORIGINAL PUBLICATION *SPRING 2007*  
WRITTEN BY *DENISE ALLEN ZWICKER*

*Diamond Offshore has become the company it is today largely through strategic acquisitions. This story takes us back to the very birth of the offshore industry, where Diamond Offshore predecessor company ODECO solved the limitations of stationary rigs by creating the first portable and reusable offshore drilling units, which were built on submersible barges. From there we trace the company's lineage and legacy of technology into the modern era of world-class, ultra-deepwater drilling rigs.*

# BARGES TO BEHEMOTHS

**FROM SHALLOW-WATER SUBMERSIBLES TO ULTRA-DEEPWATER FLOATERS, DIAMOND OFFSHORE HOLDS A LONG AND RICH HERITAGE IN THE OFFSHORE DRILLING INDUSTRY. TODAY, AFTER DECADES OF INNOVATION AND OPPORTUNISTIC MULTIPLE-COMPANY AND RIG ACQUISITIONS, WE PROVIDE CONTRACT DRILLING SERVICES TO THE ENERGY INDUSTRY AROUND THE GLOBE AND ARE A LEADER IN DEEPWATER DRILLING.**

## **A HISTORY OF INNOVATION THE PREDECESSOR COMPANIES: ODECO**

Much of Diamond Offshore's history is that of ODECO (Ocean Drilling and Exploration Co.). ODECO was founded in New Orleans in 1953 by Alden J. "Doc" Laborde. This marine engineer and commander of a destroyer escort in World War II got to know the oil field in 1947, when he went to work for Kerr-McGee, the first driller to work offshore in the Gulf of Mexico.

"In those days, they built a steel-piling platform, put a converted land rig on it, and used boats to supply it," says M.R. "Moe" Plaisance, vice president—International Operations for Diamond Offshore and a former ODECO employee. "If they drilled a good well, they had a structure in place to produce the oil or gas. But, if the well was dry, it was a lot of trouble and very costly to take down and rebuild elsewhere. Laborde noticed the way inland barges work and said 'Why not do that for offshore drilling?' He wanted to design a mobile offshore drilling unit (MODU) that could move from one spot to another without having to be rebuilt each time."

Laborde designed a platform supported by columns on top of a barge. The barge could be flooded so that the unit's hull rested on the ocean floor. When the drilling was finished, the barge could be towed to a new drilling site.

"His was the first submersible rig design in the world, and he tried to sell the design to Kerr-McGee, but they wouldn't bite," Plaisance notes. "So he quit his job and started looking for someone to back him. At last, he found Murphy Oil Co. in El Dorado, Ark. Charles Murphy ran an onshore oil company, but he saw promise offshore. And he saw this as a way to enter the offshore arena.

"Laborde needed \$1 million to build his rig, so Murphy put up \$500,000 of that (a new semisubmersible today can cost as much as \$700 million). Laborde found other investors to put up the rest. Murphy gave Laborde 10 percent and made him president. And, when Laborde built that first rig, he named it Mr. Charlie in thanks to Charles Murphy for believing in his idea," Plaisance says.

Not everyone believed. "The president of McDermott came to the shipyard where they were building Mr. Charlie and said, 'You ought to put some big pad eyes

(for lifting) on this thing so I can haul it off for salvage,'" Plaisance notes. But Laborde had the last laugh. The rig drilled a discovery well on its first attempt—the South Pass Field, near the mouth of the Mississippi River, for Shell Oil.

After a decade of working with submersibles, Laborde and his staff had noticed how stable the rigs were while they were being submerged at a location. "They tried not pumping out all of the water and moving the rig while it was partly submerged," says Plaisance. "The idea worked. So they opted to design a rig that was semisubmersible, held in place by anchors. "They built a scale model and tested the rig in Laborde's neighbor's swimming pool. They were pretty amazed that the model sat there, almost still," he says. "So they decided to build the *Ocean Driller* in 1964—which was the first purpose-built semisubmersible."

The *Ocean Driller* and its successor, *Ocean Explorer*, were the company's two prototype semisubmersibles. They ushered in a new era of offshore drilling for the growing company.

ODECO rigs pioneered exploration of the North Sea during the late 1960s,

finding seven major fields. *Ocean Viking* discovered the giant Ecofisk Field for Phillips Petroleum. *Ocean Victory* found the Piper and Claymore fields for Occidental Petroleum. *Ocean Voyager* discovered the Brent, Cormorant, and Auk fields. And *Ocean Kokuei* found the Ninian Field.

In 1969, ODECO got in the jack-up business, building the *Ocean Star* (not to be confused with Diamond Offshore's present day semisubmersible of the same name). The original *Ocean Star* is now an offshore-drilling museum at the Offshore Energy Center in Galveston, Texas. And, in 1971, ODECO designed and built the world's first self-propelled semisubmersible, *Ocean Prospector*.

In 1974, ODECO became the largest and most diversified offshore drilling contractor in the world when the company acquired Storm Drilling and Marine of Houston. The Storm deal added two semisubmersibles, four drillships, and eight jack-ups to ODECO's fleet and brought the company's worldwide drilling operations into new offshore frontiers, such as West Africa and South America.

Murphy Oil Corp. acquired 100 percent ownership of ODECO in 1991. And, in

1992, ODECO was purchased by Diamond M Corp., soon to become Diamond Offshore Drilling, Inc.

### **ZAPATA PETROLEUM CORPORATION ARETHUSA (OFFSHORE) LTD.**

At about the same time that Laborde was founding ODECO, four as-yet-unknown partners were forming another Diamond Offshore predecessor: Zapata Petroleum Corporation, an oil exploration company. The partners were George H.W. Bush (the 41st U.S. President), John Overbey, J. Hugh Liedtke, and Bill Liedtke. The fledgling company formed an offshore exploration company, Zapata Off-Shore Co., in 1954, with 30-year-old Bush as the company's president. The young company pioneered new offshore drilling equipment. (Zapata Petroleum, headed by the Liedtke brothers, later would become Pennzoil.)

Zapata also was a pioneer offshore Canada, with the Zapata Uglund semisubmersible, which was one of the first partnerships between a U.S. driller and Norwegian shipping companies. This is one of the roughest environments for drilling in the world, with rogue waves, fog, icebergs, sea ice, hurricanes and nor'easter winter storms.

The Bush link was always interesting, too. Once, during a meeting, a key Zapata person was called to the phone to talk to 'George.' Turned out that 'George' was the President of the United States!

The offshore company's name was changed to Zapata Corp. in 1982. During the downturn of the late 1980s, Zapata was in trouble and looking to sell its rig fleet. A consortium from Europe, led by Belgians, formed Arethusia (Off-Shore) Ltd. and bought the fleet in 1990. In 1996, Diamond Offshore purchased Arethusia.

### **DIAMOND M DRILLING CO.**

In the early 1960s, an onshore drilling company, Brewster-Bartle, went bankrupt. The banks that now owned the company's rigs called Don McMahon, a Texas rancher and oil man, and asked him to take over the failed company. McMahon took the challenge and formed Diamond M Drilling Co. in 1964. He named the company after Diamond M Acres, his ranch near Simonton, Texas.

In 1965, Diamond M began as an inland-barge contractor in the Gulf of Mexico, soon growing into the world's largest inland-barge drilling company.

McMahon took Diamond M public in 1970, expanding into offshore waters

with jack-up rigs, posted barges, semisubmersible rigs, and a drillship. In the early 1970s, Diamond M was one of the largest owners of barge rigs in the industry. The company expanded overseas into Brazil, Chile, West Africa, Ireland, Sicily, Tunisia, Australia, and Southeast Asia.

In the late 1970s, Western Oceanic tendered an offer to buy Diamond M. Loath to be purchased, Diamond sought and found a “white knight” in Kaneb Services, Inc.

### **PUTTING THE PIECES TOGETHER**

After the oil collapse of the 1980s, Kaneb was fighting bankruptcy. Jim Tisch of Loews Corp., New York, had been buying drilling rigs at distress prices. He approached Diamond M’s president, Bob Rose, in 1989 with an offer to buy a rig. Rose instead offered Tisch the entire company. Tisch agreed.

In 1992, Diamond M Corp. bought ODECO (with 40 rigs), briefly changing the company’s name to Diamond M-Odeco Drilling Inc. before changing the name to Diamond Offshore Drilling, Inc., in 1993.

The purchase created the world’s largest offshore drilling fleet: 52 semisubmersibles, jack-ups, offshore platform rigs, and a drillship. The company also owned and operated 32 land-based drilling rigs.

Until October 1995, Diamond Offshore was a wholly owned subsidiary of Loews Corp. Then Loews sold 30 percent of the company in an initial public offering. Diamond Offshore Drilling began trading on the New York Stock Exchange under the ticker symbol “DO.”

In April 1996, Diamond Offshore acquired Arethusa (Off-Shore) Ltd. (and 11 rigs) with stock. This reduced Loews’ stake in the company to 54 percent. Since that time, Loews’ share in the company has virtually remained constant. In December 1996, Diamond M Onshore was sold to DI Industries, Inc.

### **A LEGACY OF EXPERIENCE WORLDWIDE**

Today, all of the barge, platform and land rigs acquired in earlier transactions have been sold and additional semisubmersibles have been acquired. As a result, Diamond

Offshore’s fleet now stands at 44 rigs, including 30 semis, one drillship and 13 jack-up rigs, with two additional ultra-premium jack-up units under construction, making Diamond Offshore one of the largest drilling contractors in the world. And with more than four decades of real-world, global drilling experience, the legacies of ODECO, Zapata, and Diamond M have produced one of the most trusted drilling partners in the energy industry.







ORIGINAL PUBLICATION *SPRING 2007*  
WRITTEN BY *SCOTT REDEPENNING*

*This article completes the journey of the Ocean Endeavor's multi-million dollar transformation into an ultra-deepwater drilling powerhouse. In 2007, deepwater new-build activity was rampant as rig companies and newcomer speculators chased a fast-growing offshore*

*exploration market. Diamond Offshore remained steadfast to its strategy of converting existing rigs to the highest ultra-deepwater standards. Thus the company was able to deliver the best technologies faster at a fraction of the cost incurred by competitors.*

# ENDEAVOR(ING) TO SUCCEED

THE SHIPYARD PHASE OF THE OCEAN ENDEAVOR CONVERSION FROM MID-WATER SEMI TO ULTRA-DEEPWATER SUPER-RIG HAS BEEN COMPLETED ON TIME AND UNDER BUDGET. THAT IS NO SMALL FEAT IN THE BURGEONING E&P INDUSTRY WHERE OVER 100 NEW RIGS ARE EITHER ON THE BOOKS, UNDER CONSTRUCTION OR HAVE BEEN RECENTLY DELIVERED. FINAL COMMISSIONING IS NOW UNDER WAY.

“These days, coming out anywhere near schedule and budget shows amazing team integration,” says John Vecchio, Diamond Offshore’s Senior VP of Technical Services. “In fact, a good percentage of the budget contingency was returned, which is almost unheard of. And that is taking into account that these projects are not over-endowed with high contingencies.”

The respect attached to this accomplishment is augmented by the sheer enormity of the project. Upon arrival at Singapore’s Keppel FELS shipyard in May 2005, the 2,000-ft. water-depth-rated 2nd generation *Ocean Endeavor* was stripped to the bare bones and has now reemerged with all the splendor of a Victory Class new-build. The rig boasts 5th generation equipment, over 50,000 sq. ft. of usable deck space, 6,000 long tons of operating variable deck load, a new integrated hurricane mooring system, and comfortable accommodations for a 140-person crew. By comparison, an equivalent new-build would likely be twice as expensive and take significantly longer to finish.

Designed to drill wells up to 35,000 ft. in 10,000 ft. of water, the

*Endeavor* will be more than ready for its first assignment in the Gulf of Mexico for Devon Energy once final commissioning is complete. But before the unit is delivered to any customer, Vecchio stresses that there is an essential round of intense testing and commissioning, and “that is the time we will deal with any unexpected issues that may arise.” “Right now, the rig is in Singapore harbor awaiting the heavy lift transport ship,” Vecchio says.

“While the *Endeavor* is there, we are running the unit through the paces.” The first step is to make sure individual components like the electrical and piping are hooked up correctly. Moving to the next level, each major system is checked, such as the bulk system and mud system. Next is a full integration test, where all systems are brought online and actual drilling is simulated. “We dive right in and mix mud, make up pipe, and do just about everything else that is normally done on the job,” Vecchio says. “And we do the work with the real crew that will ultimately be working the rig.”

Although the upcoming well site is half a world away from where the *Endeavor* was upgraded, the crew has been phased in over the course of the

construction. Crewmembers have helped with equipment installation and will be there through commissioning and testing. They have been getting familiar with this rig, as well as going out to work on other upgraded Victory Class rigs in the fleet to get real hands-on application training. They have also been completing the training courses required for their individual jobs. All this so they are ready to work even before the rig is.

“All of these measures are not required by the client,” Vecchio concludes. “But we do this to make sure we are delivering a great working product. We also typically use the same third-party testing companies that our clients do, so everyone is ahead of the game. They do not have to duplicate the effort, and we know we are working from the beginning to be client-ready.”

Assuming commissioning goes smoothly, the *Ocean Endeavor* is currently slated to commence drilling in the Gulf of Mexico this summer.



OCEAN ENDEAVOR



ORIGINAL PUBLICATION *SPRING 2009*  
WRITTEN BY *SCOTT REDEPENNING*

*In 2009, yet another Diamond Offshore ultra-deepwater upgrade emerged anew from Keppel FELS Singapore shipyard and was immediately hired for work 13,000 miles away in the Gulf of Mexico. The Monarch's mooring system was specially outfitted to meet new*

*regulations set forth for drilling in the GOM in the wake of hurricanes Rita and Katrina, making the rig a coveted catch for operators. This story takes us through the last few stages of commissioning, just days before the rig began to flex its new capabilities for customers.*

# THE OCEAN MONARCH

AFTER A 2-½ - YEAR MASSING OF POWER AND MIGHT, A NEWLY UPGRADED VICTORY CLASS SEMI JOINS THE DIAMOND OFFSHORE ULTRA-DEEPWATER FLEET. IN 1997 BRUCE WILLIS STOOD ON THE HELIDECK OF THE *OCEAN MONARCH* DRIVING GOLF BALLS AT A GREENPEACE VESSEL. AT THAT TIME, THE *MONARCH* WAS AN ENSERCH-OWNED RIG AND WAS SERVING AS A MOVIE SET FOR THE FILM *ARMAGEDDON*. TWELVE YEARS, A NEW OWNER AND \$310 MILLION IN UPGRADES LATER, THE *MONARCH* JOINS HER SISTER RIG *OCEAN ENDEAVOR* AS ONE OF THE LARGEST CONVENTIONALLY MOORED FLOATERS IN DIAMOND OFFSHORE'S FLEET, AND ONE OF THE MOST CAPABLE ULTRA-DEEPWATER UNITS OPERATING IN THE GULF OF MEXICO (GOM).

# DRILLING WELLS TO 35,000 FEET IN UP TO 10,000 FEET OF WATER NECESSITATES ENORMOUS CAPACITIES. THE MONARCH HAS OVER 50,000 SQUARE FEET OF DECK SPACE AND CAN HANDLE 6,000 LONG TONS OF VARIABLE DECK LOAD.

## COMMISSIONING

Turn back the clock about 20 days. The *Monarch* floats in a staging area, moored on a 250-foot deep shelf in the GOM an hour's chopper ride from the New Orleans International Airport. This conveniently accessible location is where the final stages of rig commissioning took place. Commissioning is the process of proving that everything on the rig performs as it should, from the smallest electrical circuit to the major pieces of equipment to the rig as a whole, with all systems working in unison to simulate a real drilling operation.

This "systems integration test" is a finish line that Project Manager Aubrey Walton was eager to cross. He's been with the *Monarch* since August of 2006, when it arrived at Keppel FELS shipyard in Singapore for the upgrade. He and his team then commenced transforming the rig into its current state—virtually a

new-build unit with about 85% virgin structural work and all new state-of-the-art equipment systems.

"We basically built it from scratch," Walton says. "What little we kept was carefully inspected to ensure its soundness." (That "little" was primarily the massive hull, originally overbuilt for the rigors of the North Sea, with the fatigue life of its main columns and pontoons measured at over 100 years. So strong, in fact, is that hull that it can accommodate the large amount of additional flotation capacity necessary to support the weight of the giant new superstructure that was added.) "Everything else," Walton continues, "was created as modular components offsite in about 20 fabrication facilities around Singapore, which were then sent to the shipyard for assembly. We also had major parts of the lower hull built in China and Indonesia. All these pieces were scattered everywhere and then

came together at Keppel FELS."

Having so many new components and such a large rig makes commissioning quite the formidable task. "In all, there were about 6,000 items on our list, each needing its own test, inspection and positive result before moving on," Walton says. "Once the majority of the steel work is done, you test your engines and generators, power distribution systems, emergency control systems, lighting, saltwater pump, drill water pumps, fuel pumps, transfer pumps, purifiers, electrical controls, agitators, shakers, degassers, mixing pumps, charge pumps, mud pumps, blowout preventer system and controls, deck cranes, knuckleboom crane, bridge cranes, iron roughneck, bridge rackers, finger boards, horizontal to vertical pipe handling machines and mouse hole rotary. Just to name a few," he adds. Only 205 commissioning details of the original 6,000 remained unchecked when the rig was towed to the GOM



staging area. This work essentially boils down to four major systems and about two week's effort. These are perhaps the most elemental systems for actually drilling a well—the draw works that lift the drill string, the top drive that turns the string to drill the hole, and the crown-mounted compensator and inline tensioner, which work with instant precision to cancel wave action and protect the drill string and riser from being damaged as the rig heaves in changing seas.

### THE “LAST” BOAT OUT OF SINGAPORE

Normally commissioning takes place at or near the original shipyard. And the majority of the *Monarch's* commissioning was carried out in Singapore. But to make the 13,300-mile journey from Singapore to the GOM with any semblance of time efficiency, the rig would have to be dry-towed on a heavy-lift vessel, and those ships were in tight supply.

“We hadn't finished everything in Singapore, but we already had the Blue Marlin booked, and we had a start date for our contract fixed in the GOM. So when the vessel arrived, we elected to complete our commissioning in the Gulf rather than paying demurrage on the only ship available that could meet our schedule,” says Walton. “But we'll be fine. Some things we accomplished dockside in Singapore before we left because it's more efficient to get people and equipment to the rig. But there are other things you do at anchorage, like offshore commissioning and final crew familiarization and training. The GOM staging area is a good place to finish those items because it's only a short ride from land by boat or helicopter and only a short tow away from our first job.”

### ULTRA-DEEP MIGHT

The *Ocean Monarch* started that first job as one in an elite group of gargantuan floaters. The 171.5-foot derrick is hook load rated to 2 million pounds. Riser tension is rated to 3.6 million pounds, rotary loads to 2 million pounds and setback to 1.5 million pounds, which is the pipe weight that can be racked in the derrick. In all, the maximum combined load can reach 6.3 million pounds, with roll or pitch of 2.5 degrees, 6-foot heave and 70-knot winds.

Drilling wells to 35,000 feet in up to 10,000 feet of water necessitates enormous capacities. The *Monarch* has over 50,000 square feet of deck space and can handle 6,000 long tons of variable deck load. The rig has a drill-water capacity of 12,915 barrels, fuel oil of 6,895 barrels, liquid mud of 9,945 barrels, bulk mud storage of 13,300 cubic feet and 11,000 cubic feet of bulk cement storage. At any given time, the *Monarch* can comfortably house and feed a crew of 150 people.

The equipment list is equally impressive. One corner of the deck houses Oceaneering's Millennium Magnum Class ROV, a remotely operated vehicle system. Halliburton's HCS-ISO Advantage Combo Cementing Skid claims another corner. Mud can be driven miles beneath the seafloor via four National Oilwell Varco 14P-220 triplex mud pumps rated at 7,500-psi discharge, driven by two GE 1,100-horsepower DC motors.

All of these systems surround a leading-edge NOV drilling package built to perform in high seas, with a crown-mounted compensator rated to a 25-foot stroke with a 1-million-pound capacity that doubles to 2 million pounds when closed and locked. The derrick's racking platform has removable fingers that can accommodate 34,000 feet of 6- $\frac{5}{8}$ -inch drill pipe, some of the largest available,

and 2,000 feet of bottom hole assembly with drill collars up to 9- $\frac{1}{2}$  inches. On the seafloor thousands of feet beneath the *Monarch*, the wellhead is protected by the rig's state-of-the-art 15,000-psi blowout preventer stack with an H2S-rated lower marine riser package and ROV interface controls.

The *Monarch* is certainly built and equipped to go deep. And going deep in the GOM makes station-keeping particularly challenging, as the rig has to fight off the Gulf's infamous high-velocity loop current and inevitable seasonal hurricanes. The *Monarch* faces nature down with 12 Stevpris 15-ton anchors: eight standard plus four storm units, which at times will likely be deployed outside of hurricane season for extra assurance. Few rigs have a mooring system this robust.

The standard chain-to-wire anchors are held by 3- $\frac{3}{4}$ -inch wire with a breaking strength of 1.73 million pounds, while the storm anchors employ 3- $\frac{7}{8}$ -inch wire with a breaking strength of 1.825 million pounds. When deployed, the four additional storm anchors add up to 40% more holding capacity than the conventional eight-point mooring system alone.

*Monarch* Operations Manager Chad Williams calls extra attention to this last feature. “The 2005 hurricane season had several storms that sent a number of rigs adrift. After that we knew there would be new industry standards for mooring in the Gulf of Mexico,” he says. “But Diamond Offshore didn't wait for those to be established. We refitted virtually our entire GOM floater fleet with a 12-point mooring system. And we also mandated that any of our new rigs destined for the Gulf be outfitted with storm mooring systems.

This protects our property and the interests of our clients while keeping the rig from going adrift.” The measures we took to expand and

strengthen the mooring systems on our GOM floaters following hurricanes Rita and Katrina proved very effective, as all of our rigs held station during Ike and Gustav in 2008. In fact, four of our floaters were directly in Ike's path, but weathered the storm without significant incident. And the overall performance of our GOM floaters during the storms earned us a commendation from the Minerals Management Service for the effectiveness of our efforts.

## **DRILLING FOR ANADARKO**

The most interested client currently aboard the *Monarch* is Choney LaSade, Anadarko's Drilling Superintendent for Deepwater Drilling. Anadarko's operations in the GOM represent about 25% of the company's revenue, and LaSade is ready to put the *Monarch* to work to bolster that number.

"We're looking to drill sub-salt wells about 30,000 feet down in water about 7,000 feet deep," he says. "We've worked with Diamond Offshore rigs for several years now, primarily the 5,500-foot rated *Ocean Star*, but we've never contracted one that could handle wells quite like this. So we were glad to see the *Monarch* come out, and we hired it for a four-year term."

LaSade adds that the *Monarch's* capabilities were only part of the reason for the contract. "We have always had a great relationship with Diamond Offshore. I appreciate that the communication is always very open. While the *Monarch* was being upgraded, my team went to Singapore with the Diamond Offshore team numerous times to collaborate and share knowledge. We believe in this company and rig enough that Anadarko put some of its own capital into the upgrade."

These client-funded improvements include angling the mud pits for easier cleaning, installing a hydraulic valve

instead of a check valve on the BOP, the installation of hard piping to allow more convenient hookups for well test equipment during completions, modifying the derrick to handle bigger drill pipe and specifying a more stalwart well-head connector.

"There's one other thing about this relationship," LaSade continues.

"Anadarko has a very prominent initiative known as IIF, which stands for the Injury Incident Free workplace. Our goals are to protect people and the environment, and Diamond Offshore is completely on board with that in their own initiatives".

Chad Williams embellishes the point.

"Our rig is on Anadarko's budget, so of course we want to perform for them without downtime. Our job is to get the well down fast and get it down safe. Their spread costs are well over a million dollars a day, with our rig being about 40% of that. Anadarko needs a performer—a company that can do it faster, deeper and safer. We work hard to be that company. We set stringent policies and procedures for health, safety and environment, we train our people well, and we hold them accountable to carry our high standards forward."

This commitment is already being proven out by hard statistics.

The *Monarch* has not logged a Lost Time Incident (LTI) since coming out of the shipyard in Singapore. This is a significant record given the nature of the commissioning work and the urgent pace that was set to get the rig ready for drilling.

## **TRAINED TO PERFORM**

Again, step back a mere two weeks prior to the *Monarch's* first job. No drill pipe has been made up; no mud has been mixed. The BOP stack and ROV haven't seen a drop of seawater yet. For the moment the futuristic driller's chair is all open

panels and exposed wires. Yet in a matter of days the rig and crew will be prepared to drill. This readiness is possible because the *Monarch* has sister rigs out there drilling with similar equipment, and much of the crew has been hand-picked from those units. It was a tough job for Phil Tobey, Area Manager over the *Monarch*, *Endeavor*, *Baroness* and *Ambassador*. He had to pull crew from some of his prize vessels and get many of the personnel involved with the *Monarch* well before the rig would ever begin operations.

"We brought a lot of the guys over while the rig was in Singapore, like the drilling teams, electronic technicians, subsea engineers, maintenance techs and mechanics. Our goal was to get them familiar with the systems so they can hit the sea running when the rig's ready to go," he says. "We also trained people on our sister rigs, since the equipment systems are a lot like the *Monarch's*. There seems to be a lot of pride among the guys about coming to this brand new rig."

Confidence, and a healthy dose of anxiety is apparent in the demeanor of Driller David Punched, who is overseeing the finishing touches in his driller's shack and will soon put down the *Monarch's* first string of pipe.

"I've run a driller's chair similar to this on the 10,000-foot-rated *Ocean Confidence*, but there are some new bells and whistles on this one," he says.

"I'm a little nervous about it, to be honest, but I know it's going to be great. We have a good team and everyone's always more than happy to help. And, you know, there comes a time when you get used to what you've been doing, and you want to step out a bit and learn something new."





OCEAN COURAGE

ORIGINAL PUBLICATION *FALL 2009*  
WRITTEN BY *SCOTT REDEPENNING*

*Over the decades, through market booms and busts, Diamond Offshore has managed to navigate a steady course. This is because the company strategically zigs when others zag. The global credit crisis of 2008 presented such an opportunity. When oil prices were at record highs, many jumped into the newbuild*

*game. But when the downturn came, some couldn't make good on their commitments. Diamond Offshore moved to take over defaulted construction contracts on three rigs that were nearly complete. The company gained state-of-the-art assets at a fraction of newbuild costs.*

# GAINING COURAGE

**AS THE PRICE OF OIL MADE ITS SPECTACULAR CLIMB PAST \$140 A BARREL IN JULY 2008, DRILLING COMPANIES CLAMORED TO GET NEW-BUILD ORDERS INTO SHIPYARDS AROUND THE WORLD. NOW LOP \$75 TO \$100 OFF THAT OIL PRICE, AND THROW IN A GLOBAL CREDIT CRUNCH, AND SUDDENLY SOME OF THESE NEW RIGS ARE STANDING NEAR COMPLETION WITH DEFAULTED CONSTRUCTION PAYMENTS. ONE SUCH RIG WENT ON THE AUCTION BLOCK LAST SUMMER AND, FOLLOWING THE SALE, EMERGED UNDER A NEW NAME, THE *OCEAN COURAGE*—A HULKING DYNAMICALLY POSITIONED UNIT CAPABLE OF DRILLING 40,000-FOOT WELLS IN 10,000 FEET OF WATER.**

The *Courage* is now mobilizing to the deep waters of the Gulf of Mexico (GOM) where the first contract wells will be drilled. This is an 80-day, 13,300-mile wet tow through the Sunda Straits, across the Indian Ocean, around the Cape of Good Hope, across the Atlantic Ocean and finally to the GOM. Yet the journey the *Courage* has made to arrive on Diamond Offshore's rig roster is equally as remarkable.

## UPWARD THROUGH THE DOWNTURN

The oil & gas industry is down, with cautious optimism in near-term forecasts. But according to *Ocean Courage* Area Manager Jon Richards, challenging times like these are when Diamond Offshore sees opportunities. "The growth strategy of this Company has always been to acquire assets during downturns where you can get iron at a reduced price, and that's what they've done here," he says. "If we had placed an order for this class of vessel a year ago, we would have waited three years for delivery, and the price would have been more than \$700 million. As it stands, we're getting a rig that's essentially ready to work now, and we won the bid with a \$460 million offer. That's win-win."

Although adding assets at bargain prices is standard for Diamond Offshore, this practice has never before come in the form of a completely new rig, according to Neil Hall, operations manager for the *Courage*. "Normally, you can't go out and buy cutting-edge technology at discount prices brand new out of the shipyard. But these are not normal times," Hall says. "Our strategy is usually to buy rigs that other companies don't see value in anymore. Cases in point are the *Ocean Vanguard* and *Ocean Patriot*. We bought these mid-water units for \$65 million each in a previous down-cycle when many in the industry thought they might never work again. But work they have,

and they've paid for themselves two or three times over in the past few years. Buying the *Courage* is an extension of that opportunistic philosophy, finding value at an attractive price."

Before acquiring the *Courage*, Diamond Offshore was already well positioned with deepwater equipment, due to relatively recent Victory-class upgrades for the *Ocean Baroness*, *Ocean Rover*, *Ocean Endeavor* and *Ocean Monarch*, two 7,500-ft. rated units and two 10,000-ft. rated units, respectively — all conventionally moored semisubmersibles.

These also fit the Diamond Offshore strategy, Richards points out. "Each upgrade took less than two years and resulted in an essentially brand new ultra-deepwater rig. Building one from scratch would have taken twice as long and cost twice as much," he says. "Instead of spending capital and waiting, we've got our new rigs out there earning dayrates. The *Courage* acquisition is simply a twist on that approach. And with the *Courage*, we have added a fifth DP rig to our fleet that's as capable as, or more capable than, virtually any semi in deepwater today. This is definitely leading-edge technology."

## DYNAMIC STRENGTH

The *Courage's* first job will be to drill a series of wells for Petrobras ranging from 25,000 to 31,000 feet in about 8,300 feet of water. While these are no mere shakedown starter wells, the rig is built to handle much more. "In the Gulf of Mexico, you have to drill big or go home," says Hall. "And this rig can certainly drill with the biggest."

Atop a 324 x 299-foot lower hull, the superstructure rises 118 feet to a sprawling 244 x 244-foot main deck, crowned by a massive derrick that soars another 210 feet skyward. The derrick is rated to handle 2 million pounds of hook load, 2.5 million pounds of static load,

3.5 million pounds of riser tension and 2 million pounds of tubular setback. Smart fingerboards rack various diameters of drill pipe up to 6 5/8-in., as well as casing and drill collars. Plus the derrick supports efficient offline building of four-joint drill pipe stands and three-joint casing stands simultaneously with drilling operations. Riser sections can be racked vertically as well.

The *Courage* handles 7,000 metric tons of variable deck load, readily accommodating up to 42,000 feet of drill pipe and 10,000 feet of riser, as well as major equipment systems like the 15,000-psi-rated Schlumberger MD1000 cementing unit and Oceaneering's Magnum Class ROV with control and maintenance shacks. The rig can hold 14,613 barrels of drill water, 21,043 barrels of fuel oil, 12,178 barrels of liquid mud in the lower hulls plus another 6,808 barrels of mud in the pits. More than 34,100 cubic feet are set aside for bulk mud and cement storage, and 17,340 square feet of storage is available to hold 6,100 sacks. There's also ample room for personnel, with ultra-modern living facilities designed to comfortably feed, house and office up to 164 crew members.

Far beneath the waves, the *Courage* deploys a touch-screen-controlled 18 3/4-in. x 15,000-psi Cameron TL blowout preventer stack and H2S-rated lower marine riser package with ROV interface panels. The riser package includes 21-in. outer diameter x 75-foot Cameron Loading joints, and an Aker Marine DAT riser tensioning system rated to a total stroke of 50 feet.

Fully loaded with equipment, tubulars, supplies and personnel, the *Courage* tips the scales at 46,700 metric tons, and yet the rig is incredibly nimble — an efficient, fully automated machine designed to drill deep and get there fast. Welding this kind of deepwater might takes considerable

raw power, which comes from eight Caterpillar C280 engines split between two separate engine rooms and capable of putting out a collective 40,000 horsepower. Being a dynamically positioned rig with no anchors holding the vessel in place over the wellhead, the majority of those horses are allocated to the thrusters mounted underneath, eight 15-foot propellers that automatically pivot and adjust to keep the *Courage* perfectly in place and the riser at a safe angle, no matter what the wind, waves and currents are doing.

## **STEERING THE BOAT**

Each of the eight Rolls Royce UUC 355 full-azimuth thrusters is capable of producing 66.4 metric tons of propulsion in any direction on very short notice. These thrusters take their direction from the vessel's Class 2 Kongsberg K-Pos Dynamic Positioning package, a triple-redundant digital control system that keeps the rig fixed squarely over the well by following heading data from two differential GPS units, as well as hydro-acoustic beacons placed on the seafloor.

All DP functions are run from a bank of widescreen monitors and input panels that traverse the full length of the spacious bridge, a system that is also duplicated in the engine rooms for an extra measure of control versatility.

The Kongsberg system employs advanced computerization and sophisticated algorithms to automatically steer the vessel, yet all this technology sits idle and ineffective unless there are talented hands at the controls. This responsibility falls to the offshore installation managers / captains of the *Courage*, Michelle Gorman, Richard Annis and Carl Smith. Gorman, who happens to be the first female OIM captain in Diamond Offshore history, was hand-picked because she brings extensive DP experience to the job. Annis, on the other hand, offers longtime captain experience from his stints on

conventional vessels. Both 13-year Diamond Offshore veterans, Gorman and Annis are effectively training each other, so by the time the rig starts drilling, each will be a full-fledged OIM captain who is proficient in DP. Then they'll be able to alternate hitches and be the other's relief. Smith is also a veteran Diamond hand.

Gorman states that the timing couldn't be better for adding a robust DP vessel to the Diamond Offshore fleet, even beyond the obvious boon of getting the rig at a low purchase price.

"Ultra-deepwater is where operators want to go, and DP rigs are particularly popular in this environment because of their versatility," she says. "You don't have to go through a long mooring-up process when you arrive on location. You don't have to hire anchor boats and lay out an anchor pattern.

In fact, you can get to work on the well almost immediately once you arrive. DP rigs are also ideal for highly developed fields, like the areas we're likely headed to in the Gulf of Mexico. Developed fields have lots of pipelines and other subsea infrastructure on the bottom, making it difficult to drop an array of anchors. But DP rigs can go and work just about anywhere."

Annis points out other practical benefits of having DP thrusters on the bottom of the rig, especially in the GOM during hurricane season. "The *Courage* is basically a ship that can move under its own power," he says. "That means we can motor right out of the path of oncoming storms. We just pull the riser and BOP stack and go. Then after the storm passes, we can quickly get back on location and working." Having this kind of mobility has its less-dramatic uses as well. As the sun arcs across the sky during operations, the driller often catches a blinding glare off the glass of the driller's shack. One call up to the bridge can get the DP crew to rotate the rig to put the sun at a better angle, without interrupting operations. "Being free of anchor chains can be very

convenient," Annis says. Clint Bailey, senior DP operator and the captains' right-hand man on the bridge, enthusiastically adds his observations of the *Courage's* capabilities. "This is a state-of-the-art system. There are very few rigs out there that are its equal," he says.

"There are cameras all over the rig so we can look anywhere and everywhere from right here. We can also monitor our fire systems, ventilation, emergency shutdowns, deluge system and ballast system. We can even run that ballast system on full automatic to keep us on an even keel — that's never been done before. Plus the amount of power on this vessel is incredible. On simulation we can drill in 100 knots of wind and hold station. As for forward speed, the vessel was pushed up to 10 knots in sea trials, which is amazing. We normally wouldn't sail that fast, but this rig can obviously perform."

## **A NEW CREWING APPROACH**

Many of the major components on the *Courage* are new to Diamond Offshore. The Aker Solutions drilling package is the first in the Company's fleet. The Kongsberg DP technology is leading edge. Plus all of the rig's systems are digitally integrated at unprecedented levels for performance and safety. Even doing something as seemingly simple as moving mud from pit to pit is a complex touch-screen maneuver. Add in the fact that the rig is due to go to work in a matter of weeks, and according to *Courage* Drilling Supt. David Hammond, "We've got quite the steep learning curve to climb.

"With all of our other new-builds and upgrades, we've been 100% on top of everything from the beginning. This time it's more like buying a car right off the lot," Hammond says. "Normally on a vessel like this, we'd have operations people on board for at least a year, sometimes two years prior — going through all the schools and training to

# “ULTRA-DEEPWATER IS WHERE OPERATORS WANT TO GO, AND DP RIGS ARE PARTICULARLY POPULAR IN THIS ENVIRONMENT BECAUSE OF THEIR VERSATILITY.”

get ready to run the rig. Obviously, we don't have that kind of time.”

Corners, however, will not be cut.

Diamond Offshore has found a way to gain back some of that lost time through a unique crewing strategy that's as new to the Company as the rig itself, Jon Richards explains.

“This rig was fully crewed by the company that commissioned construction of the rig before they ran into financial difficulties and were forced to sell the unit. As soon as we won the bid for the rig, we quickly called as many of the original crew as we could, from the highest positions down, and brought them in to Houston for interviews. We needed the experience they'd already gained on this rig as it was being constructed, and we needed the labor to keep from having to draw so heavily on our other rig crews. We were very fortunate to hire about 50% of our current crew on the *Courage* from that group.

“The interviews showed that these people had been hand-picked. They had previously worked for major drilling contractors, so we felt very good about these hires. Many had spent more than a year on this rig, and we needed to retain that knowledge base. It was also good that we didn't have to pull too much talent off our other rigs.”

Toolpusher Vince Chrisovergis is one of the original hands who now dons

Diamond Offshore coveralls — a man who takes considerable paternal pride in the *Courage*. He was there when the rig was born from a slab of steel and helped raise the structure up into the giant it is today. Chrisovergis is in the drilling department, but he'd be happy to tell you about every detail of every system on board. He knows the *Courage* top to bottom, which makes him a valuable resource to Diamond Offshore.

“This Aker drilling package is incredibly complex, so our philosophy is that everyone needs to get trained everywhere,” he says from one of the three high-tech control chairs in the driller's shack. “Even a deckhand will be trained to drill.

That way we're always ready to step into any task, no matter what.

We want to get the mistakes, what I call burps, out of the way during training before we're out there working. But this system also is so automated with so many safety measures built in, it's hard to make a mistake. I'm lending my experience to the training, but we've all got a lot to learn.”

As for the Diamond Offshore personnel who were drawn from other rigs, Neil Hall says there was a strategy in this process, too.

“In several key positions, we have a Diamond Offshore veteran paired with

an original crew member as relief,”

he says. “This really facilitates information exchange both ways.

One will be strong in Diamond Offshore's management system and how we do business, and the other will have the technical understanding of the rig. Each will bring the other up to speed. “It's an ideal situation,” Hall continues. “But it's not easy. Before we can pull a crew member from one of our working rigs, we have to fill the position with a trained person, so we don't leave the other rig short. For example, we specifically chose Michelle Gorman for the OIM job, but it took two months to get her here. This is no normal rig compared to most of our others, so we were very careful about looking around our fleet to find the relevant experience, the right leadership skills and the best attitude.”

Jon Richards puts the crewing strategy in frank perspective. “We've got a unique situation here,” he says.

“Deepwater is the future, and ambitious individuals want to step up to the newest technology and advance their careers. We have people coming from different companies and areas of the world just to be on this rig. Now we have the opportunity to instill in them a culture of safety and a solid work ethic. We get to Diamondize them, so to speak. We've got all these different talents, and it's up to us to put them in the right place to make this rig all it







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WRITTEN BY *SCOTT REDEPENNING*

*As the global recession of the late 2000s dragged on, shipyards began offering newbuild contracts at drastically reduced prices. With characteristic financial sagacity, Diamond Offshore moved to take advantage of the opportunity. This article introduces the seven new rigs that were ordered—highlighting four high-*

*spec dynamically positioned drillships that rank at the top of the world's most advanced ultra-deep-water drilling units. The ships began securing contracts long before construction was complete. The Ocean BlackHawk and Ocean Onyx have now begun working, and all of these units have secured term contracts.*



# SETTING SAIL

**WITHIN THE NEXT TWO YEARS, DIAMOND OFFSHORE WILL LAUNCH THREE ULTRA-DEEPWATER DRILLSHIPS, A DEEPWATER SEMISUBMERSIBLE, AND AN ULTRA-DEEPWATER HARSH ENVIRONMENT SEMISUBMERSIBLE. ALL OF THE RIGS ALREADY HAVE CONTRACTS AND WILL HEAD DIRECTLY TO WORK.**

## ULTRA-DEEPWATER DRILLSHIPS

- OCEAN BLACKHAWK** (DELIVERED)
- OCEAN BLACKHORNET**
- OCEAN BLACKRHINO**
- OCEAN BLACKLION**



<b>GENERAL</b>	Design:	Gusto P10,000 DW
	Classification:	ABS, A1 Drillship
<b>DRILLING</b>	Dimensions:	754 ft long x 118 ft wide x 59 ft deep
	Draft:	36 ft operating / 29 ft transit
	Displacement:	70,000mT operating
	Variable Deck:	22,045T operating
	Transit Speed:	up to 12.5 knots
	Water Depths:	12,000 ft designed / 10,000 ft outfitted
	Drilling Depth:	40,000 ft
	Derrick:	NOV Dual Bottleneck, 210 ft high with 80 ft x 60 ft base, combined hook load capacity of 4,000 kips
	Drawworks:	(Main): NOV / AHD 1250, six AC electric motors, 9,000hp total, 1,250T with sixteen 2 1/8" drilling lines (Aux): NOV / AHD 750, five AC electric motors, 5,750hp total, 750T with fourteen 1 3/4" drilling lines
	Compensator:	Active Heave Compensating Drawworks
<b>POWER</b>	Rotary Table:	(Main): NOV RST 75 1/2" hydraulic, 1,375T static (Aux): NOV RST 60 1/2" hydraulic, 1,000T static
	Top Drive:	(Main): NOV TDX-1250, 1,250T with 7,500 psi (Aux): NOV TDS-8SA, 750T with 7,500 psi
<b>STORAGE</b>	Tubular handling:	2 x NOV MPT 'Hydraulic Roughneck' for tubular range 3 1/2" to 9 3/4" + 2 x NOV HR IV-ER
	Mud Pumps:	5 x NOV 14-P-220, 2,200hp, 7,500 psi
<b>CRANES</b>	Main Power:	6 x Himsen diesel engines rated 4,500kW, each driving 5,375 kVA AC generators 2 x Himsen V-type diesel engines rated 9,000kW, each driving 10,875 kVA AC generators
	Emergency Power:	V-type Cummins diesel engine rated 1,900kW driving 1x STX engine rated 1,550kW AC generator
<b>SUBSEA</b>	Liquid Mud:	15,204 bbls
	Base Oil:	7,209 bbls
<b>OTHER</b>	Brine:	13,175 bbls
	Drill Water:	18,593 bbls
<b>CRANES</b>	Potable Water:	8,834 bbls
	Bulk Material:	16,315 ft <sup>3</sup> (barite + bentonite) + 15,891 ft <sup>3</sup> (cement)
<b>OTHER</b>	Sack Storage:	6,000 sacks
	Knuckle-boom:	1 x 100 ton + 2 x 85 ton knuckle-boom
<b>OTHER</b>	AHC Subsea:	165 ton Active Heave Compensation knuckle-boom
	Diverter:	Vetco CSO 21 1/4" 500 psi diverter with 1 x 20" flow line + 2 x 16" overboard diverter lines
<b>OTHER</b>	BOP Stacks (2):	Hydril 18 3/4" 15,000 psi seven-ram preventer 2 x Hydril 18 3/4" 10,000 psi annular preventers
	C&K Manifold:	3 1/16", 15,000 psi
<b>OTHER</b>	Marine Riser:	Vetco HMF Class H 21", 75 ft long per joint
	Tensioners:	16 x 225 kips NOV wireline riser tensioners. Total capacity 3,600 kips with 50 ft of wire travel
<b>OTHER</b>	Moonpool:	73 ft x 42 ft
	Thrusters:	6 x Thrustmaster, 5,000kW azimuth thrusters with fixed pitch variable speed propellers
<b>OTHER</b>	DP System:	Kongsberg K-POS
	Dual Activity:	Yes
<b>OTHER</b>	Accommodation:	210 people
	Helideck:	Sikorsky S-61 & S-92

## MILESTONES TO COMPLETION

SHIPYARD DELIVERY DATES

2014

**OCEAN BLACKHAWK**

CONTRACT  
ANADARKO

**OCEAN ONYX**

CONTRACT  
APACHE

**OCEAN APEX**  
**OCEAN BLACKRHINO**  
**OCEAN BLACKHORNET**

# SEMISUBMERSIBLES

## OCEAN ONYX (DELIVERED)

### OCEAN APEX

<b>GENERAL</b>	Design:	Enhanced Victory Class/Crucifix Form
	Classification:	ABS Column Stabilized Drilling Unit
<b>DRILLING</b>	Dimensions:	361 ft long x 320 ft wide x 128 ft high
	Draft:	76 ft operating / 28 ft transit
	Displacement:	49,855LT operating
	Variable Deck:	7,000LT operating
	Transit Speed:	up to 3.8 knots
	Water Depths:	6,000 ft designed / 5,000 ft outfitted
	Drilling Depth:	30,000 ft
	Derrick:	NOV, 185 ft high with 40 ft x 40 ft base, load capacity of 2,000 kips
	Drawworks:	NOV UDBEL 2040, four DC electric motors, 1,000hp each, with 2" drilling line
	Compensator:	NOV drill string motion compensator, 800 kips capacity with 25 ft stroke
<b>POWER</b>	Rotary Table:	NOV RST, 49 1/2"
	Top Drive:	NOV TDX-1000, 1,000T with pipe handler
<b>STORAGE</b>	Tubular handling:	NOV ST-120 Iron Roughneck for tubular range 3 1/2" to 10" + NOV BR-10-SD-D bridge racker
	Mud Pumps:	4 x NOV 14-P 220, 2,200hp, 7,500 psi
<b>CRANES</b>	Main Power:	5 x Caterpillar C175 Tier II diesel engines rated 2,400hp each with 4,160 VAC generators
	Emergency Power:	1 x Caterpillar C32 engine rated 720 kW
<b>SUBSEA</b>	Liquid Mud:	10,798 bbls
	Base Oil:	3,315 bbls
<b>OTHER</b>	Brine:	2,000 bbls
	Drill Water:	15,456 bbls
<b>DRILLING</b>	Potable Water:	1,002 bbls
	Bulk Material:	27,010 cu ft (mud + cement)
<b>POWER</b>	Sack Storage:	5,000 sacks
	1 x 56 ton SeaTrax 6032 with 150 ft boom	
<b>STORAGE</b>	1 x 56 ton SeaTrax 7224 with 160 ft boom	
	1 x 68 ton SeaTrax 9040 with 160 ft boom	
<b>CRANES</b>	1 x 34.4mT NOV knuckle-boom crane for riser and tubular handling	
	Diverter:	Vetco 24" (ID) 500 psi with 16" flow line
<b>SUBSEA</b>	BOP Stack:	Shaffer 18 3/4" 15,000 psi five-ram preventer Shaffer dual 18 3/4" 10,000 psi annular preventers
	C&K Manifold:	3 1/16", 15,000 psi
<b>OTHER</b>	Marine Riser:	Shaffer FT-E, 75 ft long per joint
	Tensioners:	8 x 200 kips Dual Rucker wireline riser tensioners. Total capacity 1,600 kips with 50 ft of wire travel
<b>DRILLING</b>	Moonpool:	22 ft x 81 ft
	Mooring System:	(8) 3 1/4" x 4,200 ft RQ5 chains, (8) 3 3/4" x 8,800 ft wires, (8) 15T Stevpris MK6 anchors
<b>POWER</b>	Accommodation:	140 people; NR-30 compliant
	Helideck:	Sikorsky S-92; CAP 437 compliant

### OCEAN GREATWHITE

<b>GENERAL</b>	Design:	Moss CS60E Design 6th Generation, Harsh Environment
	Classification:	DNV +1A1 Column Stabilized Drilling Unit
<b>DRILLING</b>	Dimensions:	402 ft long x 255 ft wide
	Draft:	77 ft operating
	Displacement:	67,400T operating
	Variable Deck:	7,500T operating
	Transit Speed:	up to 8 knots
	Water Depth:	10,000 ft
	Drilling Depth:	35,000 ft
	Derrick:	NOV, 210 ft high with 49 ft x 52.5 ft base, load capacity of 2,500kip, capable of 900T setback
	Drawworks:	NOV SSGD, five AC electric motors, 1,150hp each, 2,000kip capacity, fourteen 2" drilling line
	Compensator:	NOV 1,000t static, 500t dynamic capacity, 25 ft stroke with Active Heave Compensation
<b>POWER</b>	Rotary Table:	NOV, 60 1/2", 1,250t
	Top Drive:	NOV TDX-1000, 1,000t
<b>STORAGE</b>	Tubular handling:	2 x NOV ARN-270 Iron Roughneck with full offline standbuilding + 2 x NOV Vertical Hydrarackers-IV-ER
	Mud Pumps:	4 x NOV 12 P-220, 2,200hp each, 7,500 psi
<b>CRANES</b>	Main Power:	8 x HH1 HiMSEN 12H32 Tier II diesel engines rated approx 6,120 kVA AC generators
	Liquid Mud:	13,332 bbls
<b>SUBSEA</b>	Base Oil:	3,962 bbls
	Brine:	3,962 bbls
<b>POWER</b>	Drill Water:	12,326 bbls
	Potable Water:	5,220 bbls
<b>STORAGE</b>	Bulk Material:	30,366 cu ft (mud + cement)
	Sack Storage:	5,000 sacks
<b>CRANES</b>	2 x 100t SeaTrax 10832 with 200 ft boom	
	1 NOV gantry crane for riser handling	
<b>SUBSEA</b>	1 x 12T NOV knuckle boom crane for tubular handling	
	Diverter:	60" Shaffer 21 1/4", 500psi with 18" flow line
<b>OTHER</b>	BOP Stack:	Shaffer 18 3/4" 15,000 psi six-ram preventer 3x NXT Double 22" Operators LFSR-CVX Full API Std 53 and BP GP10-10/10-11 compliance
	C&K Manifold:	3 1/16", 15,000 psi
<b>DRILLING</b>	Marine Riser:	Shaffer FT-H 10,000ft, 21" OD, 75 ft long per joint
	Tensioners:	8 x 450 kips double wireline riser tensioners Total capacity 3,600 kips with 50 ft of wire travel
<b>POWER</b>	Moonpool:	29.5 ft x 91.8 ft
	Mooring System:	Fitted with (2) 84mm x 320mm R5 chains w/ 18mT Stevpris Mk6 anchors for harbor mooring, capacity for (8) 84mm x 2,200m R5 chain
<b>STORAGE</b>	Accommodation:	180 people
	Helideck:	EH-101 or S-92; CAP 437 compliant

2015

2016

OCEAN BLACKLION

OCEAN GREATWHITE

# RIGS & LOCATIONS

DIAMOND OFFSHORE RIGS BY TYPE AND LOCATION



AUSTRALIA	TYPE	DEPTH(ft)	EQUIPMENT
OCEAN AMERICA	SS	5,500	SP; 15K; 3M; 5R
<b>BRAZIL</b>			
OCEAN COURAGE	SS	10,000	DP; 15K; 4M; 6R
OCEAN VALOR	SS	10,000	DP; 15K; 4M; 6R
OCEAN BARONESS	SS	8,000	VC; 15K; 4M; 4R
OCEAN ALLIANCE	SS	5,250	DP; 15K; 3M; 4R
OCEAN WINNER	SS	4,000	3M; 4R
OCEAN WORKER	SS	4,000	3M; 4R
◇ OCEAN YATZY	SS	3,300	DP; 4R
◇ OCEAN CONCORD	SS	2,300	3M; 4R
<b>CANARY ISLANDS</b>			
OCEAN CONFIDENCE	SS	10,000	DP; 15K; 4M; 6R
OCEAN VALIANT	SS	5,500	SP; 15K; 3M; 4R
<b>COLOMBIA</b>			
OCEAN CLIPPER	DS	7,875	DP; 15K; 3M; 5R
<b>ECUADOR</b>			
OCEAN SPUR	JU	300	IC
<b>GOM (U.S. AND MEXICO)</b>			
OCEAN BLACKHAWK	DS	12,000	DP; 15K; 5M; 7R
OCEAN ONYX	SS	6,000	VC; 15K; 4M; UC; 5R
OCEAN VICTORY	SS	5,500	VC; 15K; 3M; 5R
OCEAN STAR	SS	5,500	VC; 15K; 3M; 4R
OCEAN YORKTOWN	SS	2,850	3M; 4R
◇ OCEAN SARATOGA	SS	2,200	3M; 4R
OCEAN AMBASSADOR	SS	1,100	3M; 4R
OCEAN KING	JU	300	IC; 3M
OCEAN TITAN	JU	350	IC; 3M
OCEAN SCEPTER	JU	350	IC; 15K; 3M
OCEAN NUGGET	JU	300	IC
OCEAN SUMMIT	JU	300	IC
◇ OCEAN WHITTINGTON	SS	1,600	3M
◇ OCEAN NEW ERA	SS	1,500	3M; 4R
<b>INDONESIA</b>			
◇ OCEAN GENERAL	SS	3,000	3M; 4R
<b>MALAYSIA</b>			
OCEAN MONARCH	SS	10,000	VC; 15K; 4M; 5R
OCEAN ROVER	SS	8,000	VC; 15K; 4M; 5R
◇ OCEAN EPOCH	SS	3,000	3M; 4R
<b>ROMANIA</b>			
OCEAN ENDEAVOR	SS	10,000	VC; 15K; 4M; 5R
<b>SINGAPORE</b>			
◇ OCEAN APEX	SS	6,000	VC; 15K; 4M; UC; 5R
<b>SOUTH KOREA</b>			
SOUTH KOREA	TYPE	DEPTH(ft)	EQUIPMENT
◇ OCEAN BLACKHORNET	DS	12,000	DP; 15K; 5M; 7R
◇ OCEAN BLACKRHINO	DS	12,000	DP; 15K; 5M; 7R
◇ OCEAN BLACKLION	DS	12,000	DP; 15K; 5M; 7R
◇ OCEAN GREATWHITE	SS	10,000	DP; 15K; 4M; 6R

TRINIDAD AND TOBAGO	TYPE	DEPTH(ft)	EQUIPMENT
OCEAN LEXINGTON	SS	2,200	3M; 4R
<b>UNITED KINGDOM</b>			
OCEAN PATRIOT	SS	3,000	15K; 3M; 5R
OCEAN PRINCESS	SS	1,500	15K; 3M; 4R
OCEAN GUARDIAN	SS	1,500	15K; 3M; 5R
OCEAN NOMAD	SS	1,200	3M; 4R
◇ OCEAN VANGUARD	SS	1,500	15K; 3M; 4R
<b>VIETNAM</b>			
OCEAN QUEST	SS	4,000	VC; 15K; 3M; 4R

## MAP LOCATIONS

- 1 GULF OF MEXICO (U.S. AND MEXICO)**  
8 SEMISUBMERSIBLES  
1 DRILLSHIP  
5 JACK-UPS
- 2 BRAZIL / S. AMERICA**  
9 SEMISUBMERSIBLES  
1 DRILLSHIP  
1 JACK-UP
- 3 NORTH SEA**  
5 SEMISUBMERSIBLES
- 4 MEDITERRANEAN / W. AFRICA / BLACK SEA**  
3 SEMISUBMERSIBLES
- 5 AUSTRALASIA**  
8 SEMISUBMERSIBLES (2 UNDER CONSTRUCTION)  
3 DRILLSHIPS (UNDER CONSTRUCTION)

## KEY

- SS** SEMISUBMERSIBLE
- DS** DRILLSHIP
- JU** JACK-UP
- UC** UNDER CONSTRUCTION
- DP** DYNAMICALLY POSITIONED / (SP)
- IC** INDEPENDENT - LEG CANTILEVERED RIG
- VC** VICTORY CLASS
- SP** SELF-PROPELLED
- 3M** THREE MUD PUMPS
- 4M** FOUR MUD PUMPS
- 5M** FIVE MUD PUMPS
- 15K** 15,000-PSI WELL CONTROL SYSTEM
- 4R** FOUR RAM BOP
- 5R** FIVE RAM BOP
- 6R** SIX RAM BOP
- 7R** SEVEN RAM BOP
- ◇ UNDER CONSTRUCTION
- ◇ COLD STACKED

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# **THE OCEAN BLACKHAWK**

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